This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

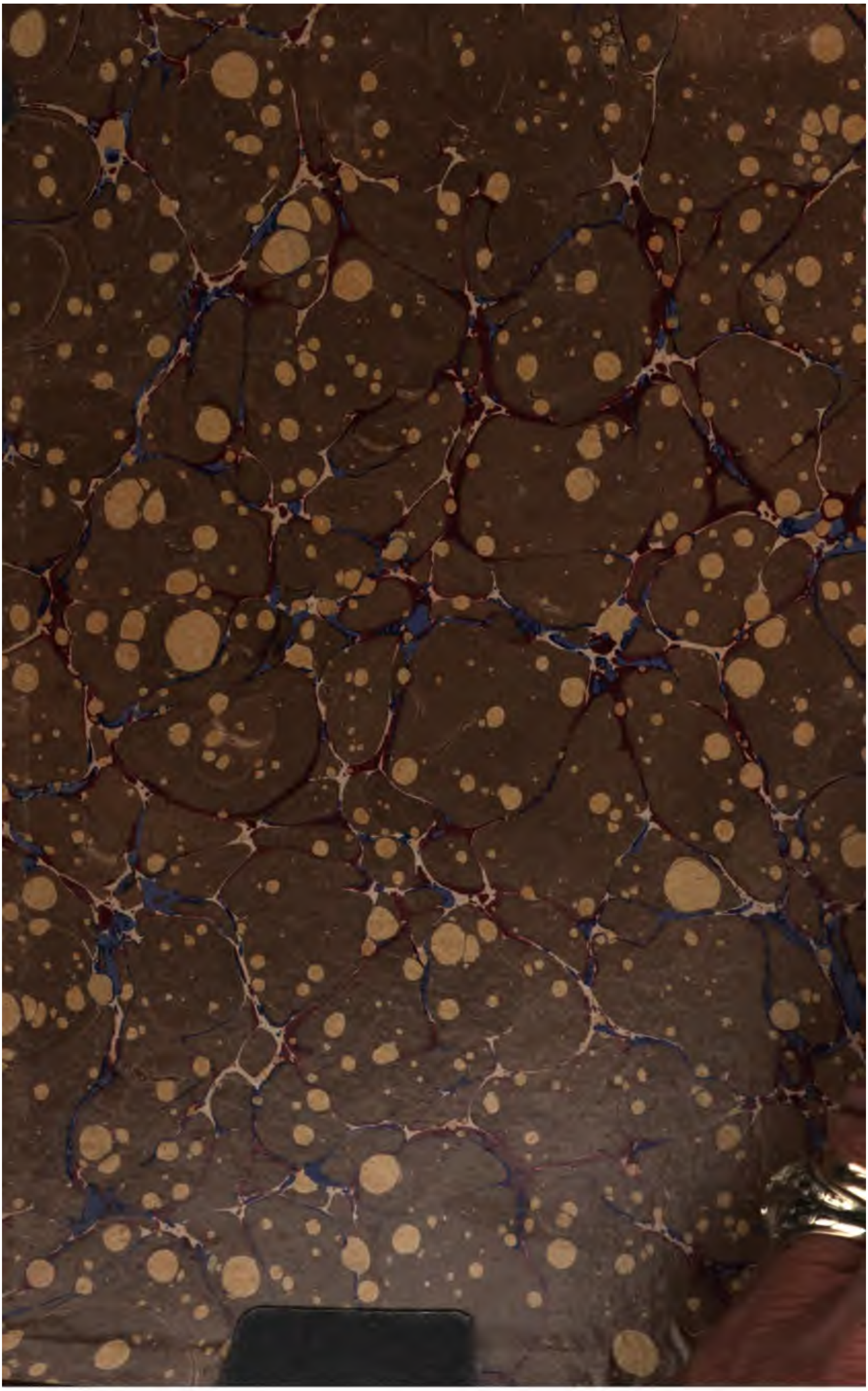
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`



THE

Psychological Review

EDITED BY

J. MARK BALDWIN
JOHNS HOPKINS UNIVERSITY

AND

J. McKEEN CATTELL
COLUMBIA UNIVERSITY

Series of Monograph Supplements,
Vol. VI., No. 1 (Whole No. 24), April, 1904.

A Study in Reaction Time and Movement,

BY

THOMAS VERNER MOORE, C.S.P.

[Submitted to the Faculty of Philosophy of the Catholic University of America in partial fulfilment of the requirements for the degree of Doctor of Philosophy.]

THE MACMILLAN COMPANY,
41 N. QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK
AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St., W. C.);
LEIPZIG (Hospital St., 10); PARIS (76 rue de Rennes).

Press of
The New Era Printing Company
Lancaster, Pa.

CONTENTS.

PAGE.
I. Introduction 1
II. Literature 4
III. Statement of the Problem 10
IV. Description of Apparatus 13
V. Experimental Results 17
  1. Reaction time and speed of movement, subject uninstructed 7
  2. The same, subject instructed to respond with quickest possible movement 20
  3. Reaction with lever, without intentional regard to speed.... 27
  4. Effect of practice on movement time 30
  5. Effect of varying preliminary signal 31
  6. Series with irregular or no signal 33
  7. Series with no signal, subject adding 35
  8. Compound reaction and speed of movement 40
  9. Movement of reaction and an independent voluntary movement 43
  10. Effect of stimuli and time of reaction and of movement..... 45
  11. Graphic curve of the movement 53
  Summary 55
VI. Theoretical Interpretations 58
  1. Physiological interpretation of contancy of movement time. 58
  2. Physiological interpretation of variation of movement under the influence of sensory stimuli 61
  3. Bearing of the experiments on Münsterberg's Action-Theory 62
    a. Outline of the theory 63
    b. Criticism of the theory 67
  4. Motor center employed in reaction 72
  5. Distinction between muscular and sensorial reactions........ 77
  Bibliography 81

87094

I. INTRODUCTION.

The problem of reaction time has already been studied by many psychologists of great merit. The various influences which lengthen or shorten reaction time have been worked out, and at first sight it would seem a most unpromising field of research. And if the attempt had been made to study reaction time alone, it is scarcely probable that anything new and important could have been brought to light. But while reaction time itself has been quite thoroughly studied, the movement by which the reaction is made has received but little attention. This neglect has arisen, in all probability, from the fact that when the problem of reaction time was being actively discussed the attention of psychologists was focused upon representative and not upon motor processes. Only of late years has movement come to the foreground, as an object of psychological study. Motor processes are being recognized more and more as important elements in conscious processes. Professor Münsterberg has even gone so far as to assert that consciousness is absolutely dependent upon the possibility of a motor discharge.[1]

The evident endeavor which asserts itself in many quarters to bring in motor processes to explain the fact of consciousness, makes it all the more important that they should be the object of experimental research. And on this account, too, a study in the psychology of movement has a value over and above whatever technical merits it may possess. Even purely physiological and anatomical studies of movement are found to have their paths of connection — long perhaps, but clearly marked — with the broader highways of philosophical inquiry. For whether the new theories are right or wrong, they will not and ought not to be laid aside, till subjected to the most searching and critical tests. And in the very nature of the case the study of movement will be of prime importance in the confirmation or rejection of any theory of consciousness which rests upon motor processes as the very groundwork of its structure.

---

[1] 'Grundzüge der Psychologie,' Vol. I., p. 530.

The phenomenon of reaction seems to offer peculiar advantages for this study. Külpe defines reaction as the 'answer given to a sensory impression by means of movement.'[1] Whether or not this movement comes as the result of conscious processes, or accompanies or perhaps precedes them, is a matter of discussion. Cattell persists in looking upon all reactions as a kind of reflex. He defines and analyzes the process as follows: "'The reaction time is the interval elapsing before a predetermined movement follows on a predetermined stimulus. During this interval a series of physiological processes takes place. (1) The stimulus is converted into a nervous impulse; (2) the nervous impulse travels along the sensory nerve and, it may be, the spinal cord to the brain; (3) through sensory tracts of the brain to a sensory center; (4) changes occur in this center; (5) these changes are followed by a discharge from a motor center; (6) the motor impulse travels along motor tracts in the brain; (7) along the motor nerve and, it may be, the spinal cord, and finally, (8) the muscle is innervated. The process is probably an acquired cerebral reflex, not accompanied by consciousness. The stimulus is indeed perceived, but probably not before the motor impulse has been discharged. The stimulus causes two sorts of cerebral changes, the discharge of the motor impulse, and changes in the cortex, which are accompanied by consciousness. But, contrary to the views of most psychologists, we think the movement does not follow on changes in consciousness, but is stimultaneous with, or actually prior to them. What volition is concerned in the process precedes the reaction and consists in preparing the motor impulse which is reflexly discharged."[2]

Directly opposite to this analysis of reaction time is that of Wundt. According to him, reaction time is made up of the following processes: "(1) Conduction from the organ of sense to the brain; (2) entrance into the field of consciousness; (3) entrance into the focal point of consciousness; (4) the stimulation of the will, which sets free the motion registered in the central organ; and (5) conduction of the motor discharge thus arisen to the muscles and the increase of energy in them."[1] The process of reaction here analyzed Wundt looks upon as complete; and it is termed by him a sensory reaction. When, however, the attention is focused upon the reacting organ, a shortened form of reaction takes place which, according to Wundt, corresponds to the analysis given by Cattell. This form of reaction Wundt terms muscular, still adhering to the distinction pointed out by L. Lange in 1888.

---

[1] 'Grundriss der Psychologie,' Leipzig, 1893, p. 421.

[2] *National Academy of Sciences*, Vol. VII., pp. 393-394.

In an article communicated to *Mind* in January, 1903,[2] Mr. W. G. Smith called attention to another factor which has a bearing upon the analysis of the reaction process. He found that with some subjects, before the prearranged reaction movement commenced, there was a preliminary movement in the opposite direction. This antagonistic movement consumed from four to five hundredths of a second and occurred in various muscles and with various movements. With some subjects it occurred constantly, with others but rarely or not at all. Physiologically he attributed this to a prior contraction of the antagonists. This was an involuntary adjustment calculated to produce a forcible movement rather than a sudden start. Psychologically, he referred the phenomenon to the dominance of the idea — first holding possession of consciousness — to hold the finger pressed down upon the key. A further consideration of this problem and its bearing on our results, will be taken up later.[3] We shall now pass on to an account of the literature bearing more particularly upon the problem under discussion.

---

[1] 'Grundzüge der physiologischen Psychologie,' 4th ed., Vol. II., p. 306. Cf. also 5th ed., Vol. III, p. 384.

[2] 'Antagonistic Reactions,' pp. 47–58.

[3] *Infra*, p. 55.

II. LITERATURE.

Since the question of reaction time is only subsidiary to our real problem, it will not be necessary to give in this paper an account of its rather extensive literature. References, however, to the various accounts of the literature of reaction time will be given in the bibliography. The motor discharge by which the reaction is made has been studied but little. Most of the previous investigations in this field of research have been concerned separately with one or the other of the two phenomena into whose relation we now inquire. Movement has been given a great deal of attention in studies of fatigue. The perception of movement and its accuracy have also been the subject of much research.

In a paper communicated to the Royal Society of London,[1] Dr. William R. Jack presented a study of the velocity of various finger movements for people of different pursuits and ages. No comparison of the velocity of movement with the time of reaction was made. Only the speed of movement was studied and its variation according to the age and ordinary life of the subject.

Dr. J. B. Haycraft published an article,[2] 'Upon the Production of Rapid Voluntary Movements,' in 1898. He measured the time of flexion of the middle finger and also found that the velocity of a movement checked in its initial stage was almost four times greater than that of a movement made in the ordinary way.

The literature which bears upon the relation between reaction time and the subsequent movement is not extensive. The problem was mentioned in a doctorate dissertation by C. B. Bliss, published in the 'Studies from the Yale Psychological Laboratory' in 1893. "In connection," he writes, "with these experiments where the attention was directed to a motion for which the reaction was a means, the idea suggested itself, but has not yet been carried out, of having a second reaction key in place of the point on the table. Then we should have recorded, in addition to the reaction time, the time required to make a certain movement. This would probably vary from time to time, with changing mental and physical conditions. None of its variations could be attributed to influences acting upon the conscious part of the reaction, for it would be purely automatic after slight practice. This might throw some light on the relative portion of the variation which is to be assigned to the purely psychical part. Possibly it might be used instead of simple reaction as a standard for comparing different kinds of reaction time."[1] Dr. Bliss made experiments in which "the reaction consisted in touching a point on the table six inches from the key. Raising the finger from the key to make this motion broke the spark coil circuit and so only the beginning of the motion was registered. Here again the mind was mistaken in judging that the reaction time was quicker than usual."

---

[1] *Proc. of the Royal Soc. of London*, Vol. LVII., 1895, pp. 477-481.

[2] *Journal of Physiology*, 1898, Vol. XXIII., pp. 1-9.

As early as 1889[2] M. Charles Féré, who has given us a number of studies in movement, undertook to investigate the relation between the time of reaction and the force of movement. He made three sets of experiments. The first was on subjects suffering from hysteria. With these subjects there was a decided difference between the pressures which the two hands were capable of exerting separately. It was found that the hand which gave the strongest dynamometric pressure reacted more quickly than the other. Furthermore, under the influence of pleasurable emotions, which were suggested to the subjects, the dynamometric pressure was strengthened and the reaction time quickened. The odor of musk strengthened both hands considerably and notably shortened the reaction time. The second series of experiments was made on epileptics. After an attack of epilepsy these subjects suffer a decided loss of muscular power. Reaction times measured after such attacks were considerably lengthened. The third series of experiments was made on normal subjects, with the aid of a specially constructed dynamometer, which could measure the force of fifty different movements of flexion and extension of the muscles which control the movements of the hand. The reaction time was measured by the d'Arsonval chronometer. It seems that the measurements of pressure and extension were taken in separate series, since the author does not tell us of any attempt to obtain the pressure of the actual movement of reaction. He sought to investigate the relation between the force a given muscle or a set of muscles was capable of exerting and the speed with which it could react. The signal for reaction was a touch on the back of the hand, the eyes of the subject being closed. The results obtained seemed to indicate that the time of reaction was a little quicker according as the muscles involved were capable of exerting greater force. In another set of experiments the recording apparatus consisted of a Marey signal, two tambours and a tuning-fork. By this apparatus it was shown (*a*) that the time of reaction for the left hand was slower than that of the right; (*b*) that the sum of the reaction times of both hands was greater when the attempt was made to react simultaneously, than when they reacted successively. M. Féré considered a similar conclusion as established, namely, that the sum of the pressure of the two hands is greater when each acts successively than when both act together. From these two results M. Féré deduced the law that the rapidity and amount of nervous discharge are greater according as the outlets are less numerous.

---

[1] *Op. cit.*, p. 37.

[2] *Revue Philosophique*, Vol. XXVIII., pp. 36–69.

In 1889, Dr. J. Orschansky touched directly upon the relation between reaction time and the subsequent movement, while investigating the nature of inhibition.[1] The amount of muscular movement in reaction, he says, is composed of two factors if we abstract from its velocity. These two factors are the intensity of muscular contraction and its amplitude. He determined the intensity of muscular contraction by making the *masseter* react against springs of three different strengths. He merely tells us that the amplitude of the contraction was recorded by the Marey tambour. But just how the extent of movement was limited — whether mechanically or by accident or by the subject's judgment — is not stated. He found that the most favorable conditions for a quick reaction were present when either the tension of the springs was at a minimum and the

[1] *Archiv für Physiologie* (*du Bois-Reymond*), 1889, pp. 173–198.

amplitude at a maximum, or the tension at a maximum and the amplitude at a minimum. This he explained by saying that the quantity of tension in the apparatus acted as a sensorial stimulus for the attention, while the idea of the extent of movement was an element in the motor representation which preceded the reaction. If, however, neither tension nor amplitude was at a maximum or a minimum, it was found that the reaction time was lengthened. This was explained on the ground that in such cases the attention had to deal with more complicated conditions. In the former case the psychic act of reaction consisted of one factor at a maximum while the other was excluded. In the latter case the attention had to deal with both factors. It is to be regretted that Dr. Orschansky did not give us a more detailed account of his experiments and furnish us with data concerning the number of experiments and their mean variation. For it is hard to pass judgment on the value of the results from the paper in its present form.

In 1892[1] M. Ch. Féré studied the relation of reaction time to the weight lifted in reacting. He arrived at the following conclusions:

For one and the same subject the reaction time is longer according as the weight to be lifted is heavier — provided that the weight is not known beforehand.

When, however, the weight to be lifted is known to the subject beforehand the length of reaction time does not vary regularly with the weight, but with the capability of the subject to adapt his attention.

Deceiving the subject as to the weight to be lifted affects the reaction time. If he expects a light weight and has to move a heavy one, the reaction time is lengthened and the ascent of the curve of movement is very oblique. If the reverse happens, the reaction time is shortened and the ascent of the curve of movement is vertical.

The time of reaction for letting a weight fall is shorter than for lifting a weight.[2]

---

[1] *Comptes Rendus de la Société de Biologie*, 9th Series, Vol. IV., 1892, pp. 432–435.

[2] This result is not against that of Dr. Orschansky, for antagonistic muscles are involved in raising and lowering a weight. In Dr. Orschansky's experiments merely the contraction or relaxation of the *masseter* was involved.

The heavier the weight the longer the reaction time of relaxation if the weight has not been supported long.

If it has been supported from one to two minutes, the longer it has been supported the longer will be the reaction time. After the onset of fatigue, however, the reaction time is shortened. M. Féré explains this last result by saying that the subject has already commenced to relax when he hears the signal.

The results of M. Féré seem to be at variance with one of the conclusions of Awramoff, whose work is mentioned below. This writer found that the quicker reaction time is obtained when the heavier weight is to be lifted. He made no attempt to harmonize his results with those of M. Féré. But some explanation of the difference may be sought in the rapidity with which Awramoff's experiments followed one upon another.

In Volume XVIII. of the *Philosophische Studien*[1] Dobri Awramoff published an article entitled 'Arbeit und Rhythmus.' The second part of this article is a study of reactions made by lifting weights. The subjects lifted a weight of three kilograms in most of these experiments. The apparatus used was an ordinary ergograph. He found that when the signals to react are given rhythmically (*e. g.*, every two seconds) the subject reacts more quickly than when the signals come at irregular intervals. He explained this phenomenon on the ground of the distinction between muscular and sensorial reaction. Irregular intervals between the stimuli make it more necessary for the subject to be on the lookout for the signal. But regular intervals occasion the subject to keep up a motor preparation for the movement. He also found that a rhythm of one second gave rise to a quicker reaction than a rhythm of two seconds. The reaction time for raising a weight of five kilograms was shorter than that for raising a weight of three kilograms. The reaction times being measured by the graphic method, a curve of the movement was obtained from which the author was able to arrive at several conclusions. The length of time the weight is held up is longer for non-rhythmic than for rhythmic reactions. The height to which the weight was lifted was greater for non-rhythmic than for rhythmic reactions. It was also claimed that the form of the curve was indicative of individual peculiarities.

[1] Pp. 515-562.

As a preliminary to a more complete paper on the study of temperament, Prof. E. B. Delabarre communicated an article 'On the Force and Rapidity of Reaction Movements' to the PSYCHOLOGICAL REVIEW in November, 1897.[1] The object of the experiments was to determine the individual peculiarities in the subject's manner of reacting. The subject's attention was therefore turned away as far as possible from the reacting movement itself so as to leave it perfectly natural and spontaneous. The apparatus used recorded the reaction time, the pressure of the reaction movement, and the duration of that part of the movement during which the pressure of the reacting muscles increased in intensity. It was found that the ratio of pressure to duration time tended in any one series to constancy. Several individual peculiarities were pointed out, but no fixed relation was found between reaction time and either the pressure or the duration of the pressure.

[1] Vol. IV., pp. 615–631.

III. STATEMENT OF THE PROBLEM.

The results just mentioned from Professor Delabarre and his associates were just what we should antecedently expect. If the force of movement is left to accident and individual temperament, there is no *a priori* probability that a constant ratio will be found between the time of reaction and the force of the subsequent movement. It was essential to the study of temperament, however, that the force of movement should not be predetermined by special choice. But over and above any question of individual temperament, there is another which is presented in a study of the movement by which a reaction is executed. This movement is the manifestation of the motor discharge by which the reaction is executed. It is the immediate result of the efferent and central processes in reaction, and can perhaps be made to throw some light on several problems in general psychology. But in order that this may be done, the motor discharge must not vary with the accidents of temperament and transient conditions. For the large accidental variations taking place under such conditions would altogether obscure the lesser fluctuations which might be due to disturbances of the attention, interpolated psychical processes, sensory stimuli, etc.

Some kind of constant must evidently be the basis of our comparison, and in this case the only constant possible is the subject's maximum effort. One is fairly sure of sending the maximum discharge from the motor center; but even after long practice it would scarcely be possible to be sure of dividing that discharge into any constant fraction. Whether or not our maximum effort is a merely subjective constant varying in its objective manifestation from moment to moment, is a problem which experiment alone can determine. But at all events, the subject's maximum effort should be constant to serve as our basis of comparison. The factor most likely to cause its objective manifestation to vary is fatigue. Fatigue would therefore enter into the results as an undesirable factor. It would obscure those lesser variations which might be due to disturbances or stimuli whose effect we seek to measure. In order, then, to eliminate this undesirable factor as far as possible, it is necessary to study the maximum speed of an unresisted movement rather than the maximum force which any given muscle or set of muscles could exert in a single contraction. The maximum rapidity of a movement is just as much the index of a motor discharge as its maximum force, and in all probability it represents a simpler discharge — approaching as near to a unit discharge as any voluntary contraction can possibly do. For these reasons it was decided to take the maximum speed of an unresisted movement, made in response to a stimulus to react as the basis of our study rather than the stronger force of movement. The fundamental problem of the whole inquiry thus took on this form: *When the attempt is made to react with the quickest possible movement, is there any relation between the time of reaction and the speed of the movement?*

The first step in the solution of this problem is evidently the choice of a movement for reaction which will serve best the scope of the present investigation. In previous investigations of reaction time, a number of movements have been selected by which the subject responded to the incoming stimulus. M. Féré, as we have said, investigated the reaction time for each of the fingers. Cattell has studied that of the finger, wrist, forearm, shoulder,[1] and foot.[2] And in some pieces of work sufficient attention has not always been paid to stating by just what movement the subject reacted. Cattell's results showed a difference between the reaction times of the wrist, forearm and shoulder. And when a subject is told to press down upon or to raise his finger from a telegraph key there are various muscles and combinations of muscles which might be brought into play unless some precautions are taken to insure the same movement each time the subject reacts. While the lack of such precautions in ordinary experiments on reaction time would be only a minor defect, it would certainly be more serious in a study which investigates the relation between reaction time and the speed of movement by which it is executed. For purposes of the present work it is of prime importance to secure the same movement throughout the entire series of experiments, unless special reason intervenes for changing its extent or abandoning it for some other.

---

[1] 'On Reaction Time and the Velocity of the Nervous Impulse,' *Nat. Acad. of Sciences*, Vol. VII., p. 410.

[2] *Loc. cit.*, p. 404.

The method of experiment suggested by Dr. Bliss for the investigation of this problem would have been open to several objections. In the first place, the path of movement would be subject to endless variation. In lifting the hand from one key to another the arm might be raised six inches or more, or pass almost in a straight line from one key to another. In the second place, varying combinations of fingers, wrist, forearm, and shoulder might be called into play, in order to touch the second telegraph key. And besides, there would be present a disturbance of a psychological character in the care that would have to be taken lest the second key should be missed.

One desirable feature in the movement is that its possible path should be of considerable extent, so that it can be measured with accuracy and also be lengthened or shortened should the experimenter so desire. But in itself there is no reason why one movement has any particular advantage over another — so long as the same movement is secured throughout. The speed of the subsequent movement is studied as an index of the motor discharge, which passes down from brain to muscle. Different cortical areas will of course be involved when different movements are made. But the motor discharge of one cortical area is just as good for our present purpose as that of any other. But it would be fatal to change, without knowing it, in the same series of experiments from one cortical area to another. This would subject the experiments to hidden variations and render trustworthy interpretations impossible.

After some consideration the movement decided upon was an outward rotation of the *humerus*. In this movement there is no work done by lifting the arm from one plane to another, and the apparatus used supported the arm, so that, as far as possible, the muscles were free from all resistance. This eliminated any complications which might arise from fatigue. Nor did the results obtained indicate they were in any way influenced by the onset of fatigue.

IV. DESCRIPTION OF APPARATUS.

The apparatus devised for the measurement of this movement was quite simple. A brass rod 53.2 cm. long and 14 mm. in diameter was pivoted at one extremity on a metal support which rested on a large semicircular wooden base of about the same radius as the rod. Near the pivoted end of the rod there was a semicircular brass rest (lined inside with felt) to support the elbow. Toward the other end of the rod there was an upright handle which the subject grasped with his right hand. This handle could be moved up or down the brass rod and fixed by means of a screw, to suit the length of arm of the subject under experiment. In one corner of the wooden base there was a metal post, through which an electrical contact was made with the lever, if the circuit were elsewhere closed. So slight was the friction of the pivoted lever that the least movement of the subject's arm sufficed to break this contact. This occasioned some trouble at first, for the subject unwittingly broke and remade contact several times before the signal to react. This could have been obviated by instructing him to keep the lever lightly pressed against the metal post until the signal to react. Such a scheme, however, would have introduced some sort of error. For at the beginning of the movement the antagonistic muscles would have to be relaxed and their resistance overcome. The amount of this resistance would also vary in each experiment, according as the subject pressed more or less heavily against the post. Accordingly a latch was devised to obviate the difficulty. A V-shaped piece of brass was pivoted on a metal post stationed at the edge of the wooden base. A steel spring was hung between a shoulder on this piece of brass and a hook on the wooden base. When the lever was at the post, one arm of the V-shaped piece of brass rested against its exterior side and by means of the spring the lever was kept in contact with the post. The resistance exerted by this spring to the start of the movement was too slight to be felt by the subject, but it sufficed to keep the contact made until the movement of reaction. Only a part of the movement made was recorded, because its absolute length was subject to accidental variations, being stopped here or there arbitrarily by the action of the antagonistic muscles, as was shown by graphic curves of the movement. The angle of movement made in nearly all of these experiments was 20°. The electric contact being broken when the lever was moved away from the metal post, it was closed again when it passed over the twenty-degree mark, by a specially devised contact apparatus. About 6 cm. from the end of the lever a clamp held a rather stiff steel wire, which passed downward about 15 mm. and then bending at a right angle extended as far as the edge of the wooden base. This piece of flexible wire served to close a contact apparatus or key, situated on the edge of the wooden base about twenty degrees from the metal post. Several different keys were tried. That finally adopted consisted of a semicircle of thin sheet brass filed down at the ends and pivoted at the center of the circle. The single radius passed upward from the pivot to the semicircle and was thence continued about 2 cm. This upward projection was covered by a piece of soft rubber tubing, which served as insulation and also to deaden the sound. When the piece of steel wire struck the rubber it threw this semicircular piece of brass over until it was clasped by two jaws of spring-brass, an electric contact being thereby established and a record made of the end of the movement. Both this contact and that at the post were on the same circuit as an electromagnetic sound-hammer which gave the signal for reaction. The hammer was operated, of course, independently of this circuit and served both to give the preparatory signal and the stimulus for reaction. On breaking the sound-hammer circuit, the electromagnet was demagnetized, the hammer was pulled up by a spring and struck a bell above. This gave the warning signal. On closing this circuit again the hammer was drawn and struck a metal anvil. This stroke closed the same circuit in which the lever, above described, was connected. The sound served as a signal to react. The closing of the circuit was recorded in another room by an electromagnetic time-marker, which wrote on a smoked drum and gave five hundred double vibrations a second. When this same circuit was broken by the outward movement of the arm, and closed again as the lever passed the twenty-degree mark, both the breaking and the making of the circuit were again recorded by the electromagnetic time-marker in the distant room. The giving of preparatory signal and the sound stimulus for reaction was done mechanically by a slight modification of the older form of apparatus which Wundt called the time-sense apparatus, and described in the fourth edition of his 'Grundzüge der physiologischen Psychologie.'[1] One of the contact-breakers there described served to break the current, thus giving the preparatory signal. A metal bar was placed on another one of these contrivances, and when the steel projection on the wheel of the apparatus reached this bar, contact was established and the rotation of the apparatus stopped. A special series of experiments was made by which this instrument was calibrated so as to measure, quite accurately, intervals of one-half second. The interval between the preparatory signal and the stimulus for reaction could then be varied at will, by placing the contact-breaker at the proper number of degrees from the metal bar.

A single pole switch was connected with the wires running to the contact-breaker so that the circuit could be closed by it, and the wheel moved back to a definite starting point without again breaking the circuit and confusing the signals in the reacting-room. A diagram of the connections is given below. The drum used to take the records was turned by hand. The axis of this drum was an endless screw, by means of which it was moved backwards or forwards about 3 mm. at each revolution. The tuning-fork and time-marker were clamped on stands which, after being properly adjusted, were screwed down to a wooden platform. This platform was supported at two corners by metal rods to which it was pivoted. Two metal rings, connected eccentrically by an axis, supported the other two corners. Turning a handle on one end of this axis raised or lowered the platform, thus raising the time-marker and tuning-fork from the smoked drum, or lowering them upon it till the proper pressure was exerted to secure a continuous record. After some practice the experimenter was able to take about forty records on the drum, which was 14 cm. long and 16.7 cm. in diameter.

---

[1] Vol. II., p. 422.

The subjects who took part in these experiments were Dr. Pace and several students of the university. Only after a set of experiments was completed were the results made known to the subjects. And though in certain cases the experimenter expected the results obtained, his surmises were not communicated to the subjects beforehand. This, of course, is a very important precaution in psychological experiments, for a biased mental attitude of the subject is very likely to affect the results obtained. Unless otherwise mentioned, the subjects had made several practice-series before the results recorded below were obtained. The principal subjects in these experiments were Dr. Pace (*A*), Mr. McMullen (*B*), Mr. Fagan (*C*), and Mr. Mullaly (*D*). These subjects will hereafter be referred to by the letters in parentheses after their names. Other subjects who made but a few experiments will be referred to by arabic numerals.

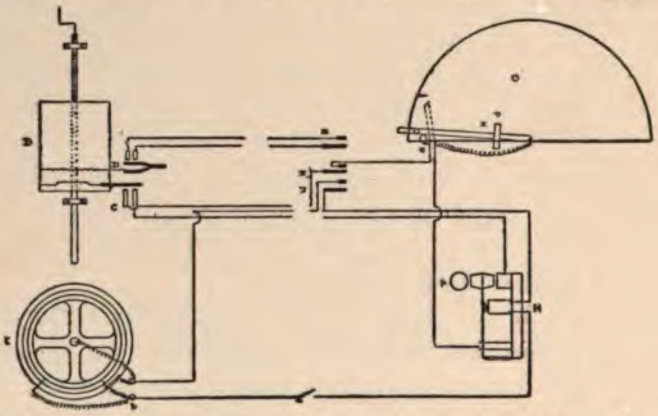


FIG. I. *A*, time sense apparatus; *a*, bar contact maker; *b*, contact breaker; *c*, one pole switch; *B*, recording drum; *C*, electromagnetic marker; *D*, tuning fork; *E*, electromagnetic sound hammer; *F*, bell; *G*, wooden base for lever; *H*, lever; *d*, arm-rest; *e*, starting past first contact apparatus; *f*, second contact apparatus; *I II III*, batteries.

V. EXPERIMENTAL RESULTS.

1. RELATION BETWEEN REACTION TIME AND THE SPEED OF SUBSEQUENT MOVEMENT WHEN THE SUBJECT IS NOT INSTRUCTED TO MAKE A RAPID MOVEMENT.

The few experiments here recorded bear upon the same problem which was undertaken by Professor Delabarre and his associates. Though not the first experiments in the order of time, they are given the first place in this dissertation because they have the nature of a preliminary study rather than an integral part of the problem under discussion. The purpose of this set of experiments was to determine whether or not any relation might exist between the variations in reaction time and the different speeds of movement with which each reaction might happen to be made. While there seemed to be no reason to doubt Professor Delabarre's conclusion, or to expect that the speed of movement would reveal a relation which a study of the force of movement failed to detect, still it was thought best to see if a new method and different apparatus would confirm previous results.

The subjects chosen for these experiments were totally unfamiliar with the work, and knew nothing of the experiments in which the subjects had been told to react with the quickest possible movement. The reason for the choice of such men was to secure a perfectly spontaneous movement. Subjects previously practiced in the quickest possible movement would have found it hard to react with a movement uninfluenced by their previous training. The subjects chosen had never practiced reaction at all; but this was by no means a necessary qualification for the present experiment. For if, by any possibility, a slow movement were the invariable result of a slow reaction and a quick movement of a quick reaction, or *vice versa*, it would not make any difference whether the subject had previously practiced reaction or not. Practice would merely lessen both variations.

The subjects were instructed to respond to the signal for reaction by moving outward the lever above described as soon as they could. Nothing was said to them about making a rapid movement, or taking care to pass the twenty-degree line; but it was found that the natural movement was always greater than twenty degrees. The results are tabulated below. In these and the following tables time is expressed in thousandths of a second (σ) under the tables headed *Reaction*, *Movement*, and *M. V.*, which signify respectively reaction time, movement time, and mean variation. In the column headed *No.* the number of experiments is given. It may be stated here, once for all, that by reaction time I mean the process usually so designated. By movement time, or speed of movement, I mean the time elapsing during a certain part of the movement by which the reaction is executed. The close of the reaction time marks the beginning of the movement time, which is itself completed when the arm passes through the angle agreed upon. Unless otherwise noted the angle in all of the subsequent experiments is one of twenty degrees; the preparatory signal was given two seconds before the tap of the hammer which served as a stimulus for reaction.

SUBJECT 1.

Series I. Angle of Movement 20°.

Reaction.	M. V.	No.	Movement.	M. V.	No.
186	22	10	117	10	10

Series II. Angle of Movement 12°.

Reaction.	M. V.	No.	Movement.	M. V.	No.
158	36	13	140	20	13

SUBJECT 2.

Reaction.	M. V.	No.	Movement.	M. V.	No.
170	33	11	189	23	12

These tables show that, while the variation in movement time under the conditions of these experiments is less than in the reaction time, still it may be considerable. In order to bring out clearly how the two times vary, curves have been plotted which represent the variations in five-hundredths of a second. The continuous lines represent the reaction time, the dotted ones the movement time. The figures along the axis of abscissas refer to the number of the experiment in each series; those along the axis of ordinates to time in five-hundredths of a second. Here and elsewhere a break in a curve indicates an unrecorded reaction time or movement time.

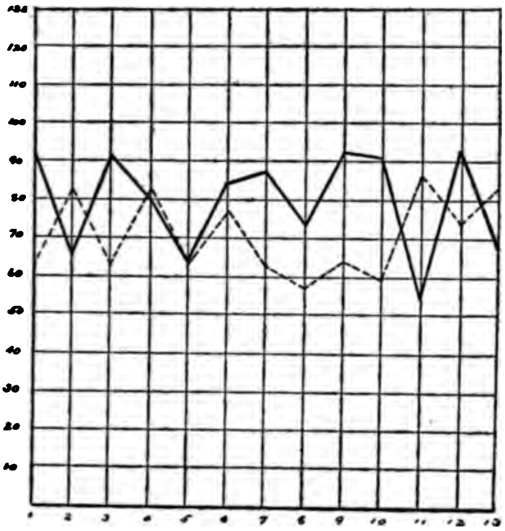


FIG. 2.

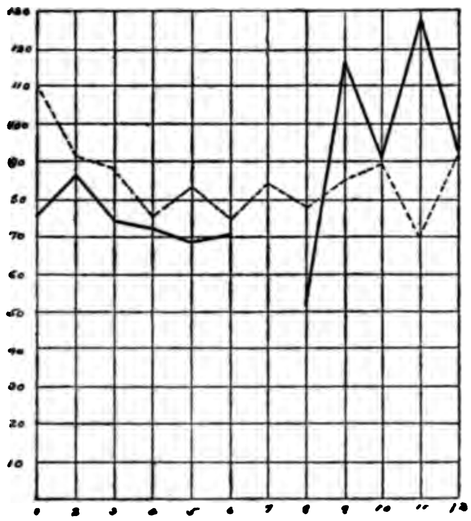


FIG. 3.

From these curves it is evident that the time of reaction may increase concomitantly with the movement time, or the reverse may take place. One may increase or decrease considerably while the other is but slightly changed.

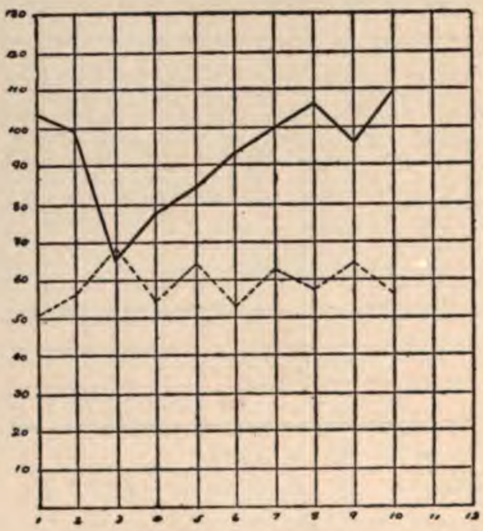


FIG. 4.

2. Relation Between Reaction Time and Movement Time When the Subject is Told to Respond to the Stimulus With the Quickest Possible Movement.

The experiments given under this heading bear upon the fundamental problem of the dissertation. What relation, if any, exists between reaction time and its movement time, when the subject is not only instructed to respond to the stimulus as soon as possible, but also by the most rapid movement of which he is capable? Sufficient has already been said about this problem to bring out the purpose of the experiments given below. But it should be noted that the mental attitude of the subject is not the same as in an ordinary simple reaction. There is another factor present in the preparation for the reaction. Not only is the idea of starting as *soon* as possible in the subject's mind, but there is also an additional motor representation. He must make the fastest movement of which he is capable. The two ideas, however, do not seem to be antagonistic. They harmonize so well that one does not feel that much more additional effort is required to react with the quickest possible movement than if the movement were left undetermined by any previous instruction.

SUBJECT A.

I. Series in which the Preparatory Signal was 4½ Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
167	12	6	118	4	6
165	27	9	116	10	9
155	13	10	115	5	10
137	27	7	113	4	7
122	11	9	120	7	9
156	54	7	136	9	7
137	21	13	103	6	13
144	23	11	121	6	11
155	29	9	122	5	9
143	16	13	101	3	13

II. Series in which the Preparatory Signal was 2 Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
147	7	10	108	7	11
141	19	10	107	4	10
151	13	8	107	5	10
157	16	10	114	7	10
164	18	13	120	5	14
143	12	14	112	5	14
168	20	12	110	6	13
160	14	12	111	4	12
156	11	11	106	4	12
166	27	9	115	5	9
159	14	11	112	4	10
175	6	10	119	5	12
180	27	10	116	5	10
140	26	8	110	5	11
137	22	11	113	5	14
123	14	10	110	3	10
159	18	10	112	4	11
129	16	9	104	2	10
163	26	11	102	5	13

The results obtained from this line of work are here given.

SUBJECT B.

I. Series in which the Preparatory Signal was 4½ Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
109	8	9	100	6	9
109	12	8	100	4	8
117	9	8	99	6	8
147	22	7	92	6	8
136	15	16	102	1	16
142	17	10	101	4	10
143	13	10	98	2	10
152	19	10	96	3	10
133	11	9	92	3	9
148	22	9	100	3	9
166	31	12	94	5	12
133	12	10	96	3	10
161	46	12	91	3	12
136	12	10	95	3	10
141	19	12	94	3	12

II. Series in which the Preparatory Signal was 2 Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
145	16	13	84	6	13
151	18	13	83	4	13
147	14	11	98	5	12
155	11	12	90	4	13
165	11	11	86	3	11
155	15	13	77	3	13
171	14	12	87	3	13
158	39	8	89	3	8
164	30	9	93	3	8
113	26	13	95	4	13
168	22	26	86	5	36
150	10	10	85	6	10
148	35	8	85	4	7
148	11	14	90	2	14
134	12	14	97	2	12
109	8	12	103	3	12
166	32	8	85	4	8
156	11	10	88	6	10
158	20	16	81	4	17
130	14	10	95	3	11
143	16	11	94	4	11
104	9	10	102	1	7
114	10	12	96	3	12
123	7	11	98	4	11
141	16	11	93	3	11
158	16	12	95	5	13

SUBJECT C.

Preparatory Signal 2 Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
103	11	10	102	1	11
134	29	10	97	3	11
145	8	13	104	6	13
151	14	12	102	3	12
156	17	13	117	7	13
142	14	13	107	4	13

SUBJECT D.

I. Series in which the Preparatory Signal was 4½ Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
162	25	11	119	4	12
159	22	10	121	6	12
162	40	13	112	6	13
146	10	10	118	4	11

II. Series in which the Preparatary Signal was 2 Seconds.

Reaction.	M. V.	No.	Movement.	M.V.	No.
191	26	12	97	6	13
170	16	13	93	7	13
148	16	12	104	5	12
164	27	12	113	4	12

In examining the results obtained in these tables the following points are at once evident. The reaction times are usually somewhat longer than muscular reactions made with a telegraph-key to sound stimuli. The mean variations of the reaction times are also longer than those generally found in muscular reactions. The mean variation of the movement time is about five thousandths of a second. Subject *D* had the most variable movement time; but the results recorded under heading (I.) for this subject were the first taken from him; and the series given in the second division were taken at rather long intervals of time. The subject was not trained to the work. Notwithstanding this fact, the time of movement varies but little — less indeed than the time of ordinary muscular reactions.

The fact that the subjects were told to make the quickest possible movement required attention to the movement — the condition most favorable for a muscular reaction. Previous to reaction there was noticed a tension of the muscles, which seemed to show that the strain of attention was directed to the efferent and not to the afferent side of the process. Occasional erroneous reactions (*e. g.*, to the preparatory signal) and previous reactions were also noticed. From these facts it seems most probable that the reactions here recorded are what the Wundtian school would consider muscular. The variation from the usual time of muscular reaction and the larger mean variation may be accounted for on two grounds. In the first place, as Cattell has found, the reaction time for the shoulder is longer than that for wrist and finger, which have usually been employed in experiments on reaction time. In the second place, no attempt has been made to secure uniformity by excluding figures which were considerably above the mean value of a series. Only the most exceptionally long (*e. g.*, 400 σ) or short reactions (*e. g.*, 50 σ) have been omitted. And it scarcely need be said that the same rule was applied to the movement time. These very exceptional values, however, occurred but seldom for reaction time, and almost never in the records of the movement. The reason for this method of procedure is, of course, apparent. A relation was sought between the variations in reaction time and those which might exist in the movement time. Hence, only the most exceptional variations in reaction time should be excluded. And it may be appropriate to state here that I cannot wholly agree with Cattell when he says, "Owing, however, to the reflex nature of the reaction, its length is not greatly affected by the condition of the observer, the time of day, the number of reactions already made, nor the amount of practice."[1] I have found quite a difference in the mean value of reaction time on different days; and it would be hard to explain this except on the supposition of variations in the condition of the subject. With subject *C* I am quite certain that anything approaching regularity was only attained after considerable practice. With other subjects I have found that the very first series taken from them was very constant and apparently of the muscular form. The statement that reaction time is not greatly affected by the amount of practice seems to indicate a change in the author's position since 1886. He then wrote: "When a subject has had no practice in making reactions (in which case the reaction time is usually longer than 150 σ) I think the will-time precedes the reaction."[1]

---

[1] 'On Reaction Times and Velocity of the Nervous Impulse,' *Nat. Acad. of Sciences*, Vol. VII., p. 394.

Just what position is taken in this paper on the distinction between muscular and sensorial reactions, and the theory of types, will best be mentioned in the theoretical discussion of the results. For the present it will suffice to recognize provisionally Lange's distinction between muscular and sensorial reactions.

The empirical conclusion that the set of experiments warrants is this: When a subject is told to react with the quickest possible movement, the reaction time may be subject to considerable variation, but the movement time remains fairly constant.

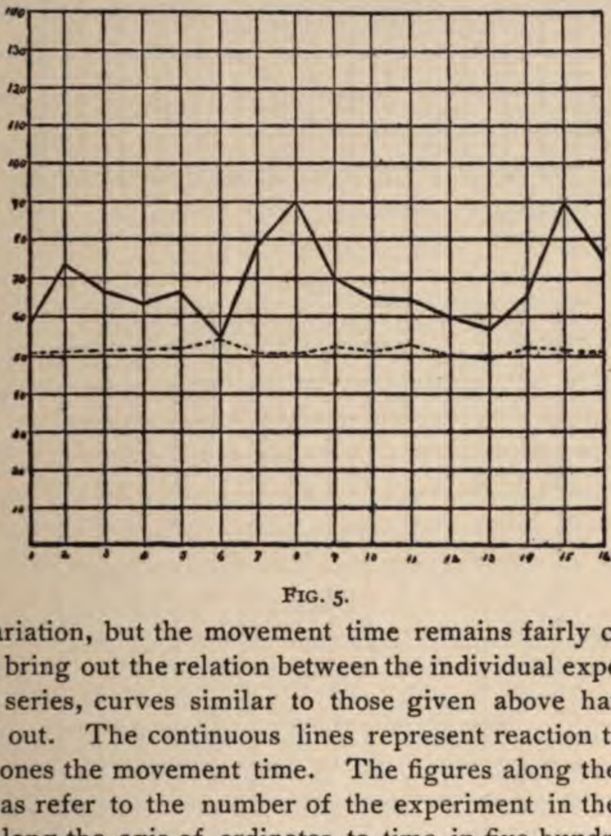


FIG. 5.

To bring out the relation between the individual experiments of the series, curves similar to those given above have been plotted out. The continuous lines represent reaction time, the dotted ones the movement time. The figures along the axis of abscissas refer to the number of the experiment in the series; those along the axis of ordinates to time in five-hundredths of a second.

---

[1] *Philosophische Studien*, Vol. III., p. 322. Also in *Mind*, 1886, Vol. XI., p. 232.

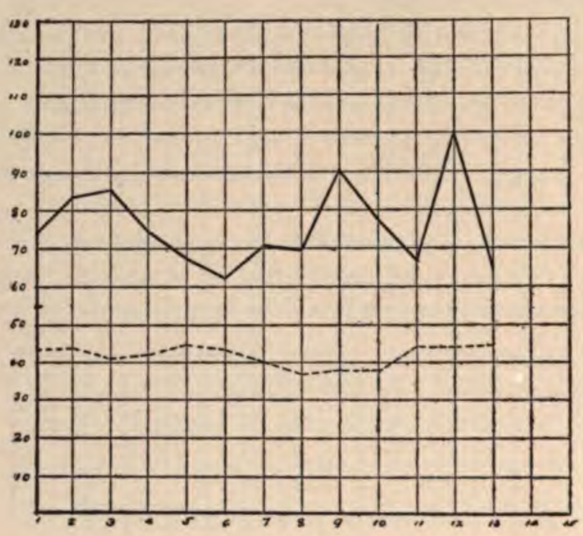
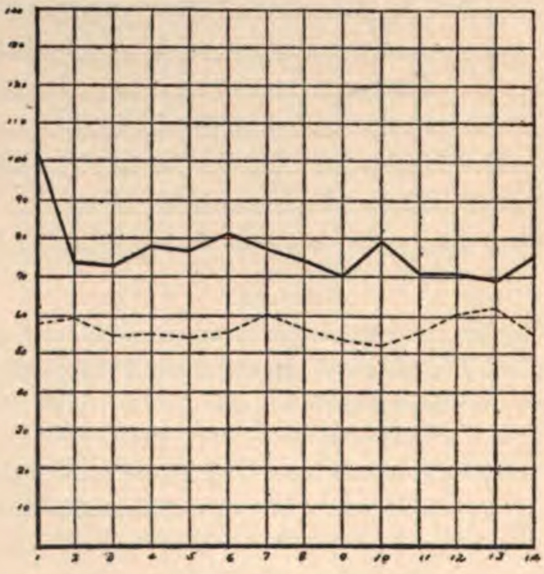

130
120
110
100
90
80
70
60
50
40
30
20
10
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

FIG. 6.


140
130
120
110
100
90
80
70
60
50
40
30
20
10
1
2
3
4
5
6
7
8
9
10
11
12
13
14

From these curves it is at once evident that the line for reaction is subject to considerably more irregularity than the one for movement. The curves also bring out more than the tabulated results of mean values. For if there were a constant ratio between the slight variations in the movement time and the large differences in the reaction times, it would not appear in the table of mean values. But when we look at these curves it can easily be seen that no such relation exists. A reaction which is longer than the average is sometimes followed by a movement whose value is less than the mean. And then, again, the reverse may take place or both may vary in the same direction. So that it is clearly impossible to state that any direct or inverse ratio exists between the two times.

3. RECORD OF REACTION WITH LEVER, BUT WITHOUT INTENTIONAL REGARD TO THE SPEED OF THE SUBSEQUENT MOVEMENT, FROM A SUBJECT PREVIOUSLY PRACTICED IN MAKING THE MOVEMENT AS QUICK AS POSSIBLE.

As we said in introducing the last set of experiments, the mental conditions under which they were made varied somewhat from the normal state of preparation for simple reactions. The mental state was more complex. There was an added element in the motor preparation for the reaction. The subject had not only to prepare to move as soon as possible, but also in moving to do so as fast as he could. The added element in the motor preparation for the movement required, as we said, a certain amount of attention to the movement, occasioning thereby a tendency towards muscular reaction. Does this more complex mental attitude in any way affect the time of reaction or not? Will the two ideas so harmonize as to leave the time of reaction unchanged? Or, if the subject is not instructed to make a rapid movement, will this simplification of the motor preparation make it easier for him to react sooner and thereby shorten the reaction? Or will the removal of the idea of making a fast movement make less likely the focusing of the attention on efferent processes, thereby allowing scope for the sensorial form of reaction and lengthening the mean time?

Experiments were made on Subject *A*, in order to throw some light on these questions. Ten series were taken, giving in all a hundred and nineteen experiments. This subject was instructed to react as soon as he could on hearing the proper signal, but to take no care of the subsequent movement whether it was fast or slow. To help towards an indifferent state of mind in regard to the movement the contact apparatus was removed from its position on the wooden base of the apparatus. This subject's previous experiments had been made with an interval of four and a half seconds between the preparatory signal and the stimulus for reaction. The same interval was allowed in the following experiments. The first three series were taken consecutively on December 12, and the rest were made consecutively five days later. No other experiments were made with this subject between these two sets of experiments. Before commencing the first set it had been one day since he had made any experiments at all. These intervals allowed to some extent the previous idea of reacting with a rapid movement to die away.

SUBJECT A.

Reaction.	M. V.	No.	Reaction.	M. V.	No.
144	18	11	129	18	12
141	19	12	155	30	13
161	17	11	131	19	12
139	18	11	133	14	11
140	18	12	132	18	13

In comparing these results with those of the same subject when he attempted to react with the quickest possible movement (preparatory signal four and a half seconds)[1] we find that in general the reaction time in the series just reported is somewhat quicker and the mean variation less than in the former series. At first sight it would seem that these results are against our former statement that attention to making the movement as quickly as possible gave a tendency to react in a muscular manner. But this is not the case, as will appear on a little closer analysis. Subject *A* (Dr. Pace) had practised reaction before taking up this series of experiments. His reactions in those experiments were of the sensory type. When commencing to act as subject in these experiments his first practice series were generally of the longer form with occasional shorter and apparently muscular reactions. Under the influence, as it would appear, of the idea of making the movement as quick as possible, his reactions soon became quicker until they were of the length already tabulated. They have never been, except in a few series, of the extreme muscular form. When, however, he was told in the series just reported to react without regard for the movement, the influence of his late practice was still felt and the tendency to muscular reaction remained. But, while it seems that direction of the attention towards the attainment of speed in the movement of reaction gives a tendency towards a muscular reaction, still it must be admitted that the more complex mental state may be something of a hindrance — at least with this subject. It is a well-known fact that thinking of how we are to perform an action makes us clumsy. A mental representation of a movement is not the most favorable condition for its execution. But a *mental representation* of a movement and the *muscular tension* in preparation for the movement are two very different things. It is the muscular tension which makes the favorable condition for a muscular reaction, not the mental picture. In reacting, therefore, with the quickest possible movement there are two factors to be taken into consideration. One is the muscular tension which prepares us for a sudden movement and indicates that the attention is strained upon the efferent processes. The other is the mental picture of moving the arm rapidly through the angle agreed upon. The muscular tension gives the tendency towards the quicker form of reaction, the mental picture tends to interfere with a quick reaction. The necessity of making a rapid movement developed this condition of tension, and led subject *A* to drop his previous sensorial form of reaction. The idea in his mind of making a rapid movement tended to interfere with the start of the movement, for when this idea was put out of mind the reaction time quickened and the mean variation was lessened. It is to be regretted that more time was not at hand to go further into the question of practice in relation to our experiments than we have done. The experiments to be reported in the next section bear more upon the attainment of constancy in the speed of movement than the effect of practice on reaction time.

---

[1] *Supra*, p. 21.

4. THE EFFECT OF PRACTICE ON MOVEMENT TIME.

A full study of the influence of practice on reaction time and movement time should be the object of a special piece of research rather than a part of our present investigation. Several subjects should be practised in the ordinary form of reaction with a telegraph key. They should be practiced in reacting with the lever without care for the speed of the subsequent movement. The effect of directing the attention to stimulus or muscle should be ascertained. And if subjects were found who could react only in the sensorial manner, these especially should be practised in reacting with the quickest possible movement. The results obtained might throw some new light on the discussion between the Wundtian school and the supporters of Professor Baldwin and his theory of types. But such an investigation would be beyond the limits of the present study. The question of practice probably would not have been mentioned at all had it not been noticed that fair constancy in the speed of movement was obtained almost from the very start with all our subjects but one.

To see with what constancy of movement subjects might react who had no practice at all, several students were asked to take part in the experiments who had not previously been employed for this line of work. They were instructed to react as quickly as they could on hearing the proper signal, and move the lever through the angle of twenty degrees as fast as they could. A few unrecorded trials were made to familiarize them with the signals and then the following series were taken.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
Subject (3)	135	20	10	106	3	10
Subject (4)	106	9	11	109	3	11
Subject (5)	151	15	5	127	4	5
Subject (6)	165	31	10	88	3	10

(Subjects (5) and (6) had made a few trial experiments about two months previously.)

With one of these subjects the mean variation in reaction time was nine thousandths of a second, that in movement time three thousandths. This was the very first series of reactions he had ever made. No doubt further practice would only show that the general statement of Cattell's criticised above[1] holds good for this subject. With all these subjects the constancy in the movement time was attained without previous practice. This is quite likely to be generally true in regard to movement time; but there are a number of normal subjects who do not react constantly except after practice and some never attain to constancy at all.[2]

5. EFFECT OF VARYING THE PREPARATORY SIGNAL IN SUCCESSIVE SERIES.

In previous experiments we have been mainly concerned with the relation between reaction time and movement time under what we may consider as normal conditions. If not absolutely normal, they are normal relative to the present research. We have already stated why it was decided to investigate the relation between reaction time and its speed of movement, made as fast as possible. And that relation being the basis of the work, it will serve as a form of comparison for reactions and movements made under the influence of various other conditions. A number of factors have been studied out and are known to influence reaction time to a greater or less extent. It will now be our object to study the influence which these factors may have on both the time of reaction and the speed of movement. The interest which accrues from the study of this problem arises from the fact that some light may be thrown upon the question of just what processes of reaction time these disturbing factors affect. Will those factors which affect reaction time have the same or a different or no effect at all on the movement time?

The study was commenced with those factors which have been supposed to affect reaction time by their influence on the attention. It has long been known that the interval between the preparatory signal and the stimulus for reaction affects the time of reaction.[3] In order to test what effect this interval might have on the movement, several series were taken consecutively in which that interval was of different lengths. The results are given below. The dates are published for each series, and when several series have the same date, they were taken consecutively. The reason for taking these consecutive series was that both the time of movement and the reaction time vary somewhat from day to day. This variation must be eliminated as far as possible if any true comparison is to be made.

---

[1] *Supra*, p. 24.

[2] *Cf.* E. B. Titchener, *Mind*, 1895, N. S., Vol. IV., p. 506-7.

[3] Dwelshauwers, *Phil. Stud.*, VI., p. 217-249. Martius, *Phil. Stud.*, VI., p. 199, ff.

SUBJECT A.

I. Preparatory Signal One Second.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
12/25	141	12	12	114	6	12
12/25	157	10	10	107	4	10
12/25	153	15	10	105	2	12
12/25	169	15	9	108	5	12
12/25	155	23	13	107	5	14
Serial Means,	155	15		108	4	

II. Preparatory Signal Two Seconds.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
12/25	147	7	10	108	7	11
12/25	141	19	10	107	4	10
12/25	151	13	8	107	5	10
12/25	157	16	10	114	7	10
Serial Means,	149	14		109	6	

SUBJECT C.

I. Preparatory Signal One Second.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
12/26	150	12	12	105	4	12
12/26	171	19	12	99	3	12
12/26	118	24	10	101	4	13
Serial Means,	146	18		102	4	

II. Preparatory Signal Two Seconds.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
12/26	103	11	10	102	1	11
12/26	134	29	10	97	3	11
12/29	144	8	13	104	6	13
12/29	151	14	12	102	3	12
Serial Means,	133	16		101	3	

III. Preparatory Signal Three Seconds.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
12/26	152	17	9	106	5	11
12/26	157	20	10	97	3	12
12/29	144	8	13	100	3	13
12/29	140	10	11	99	4	13
Serial Means,	148	14		101	4	

These results indicate that when the preparatory signal comes two seconds before the reaction stimulus, the conditions are slightly more favorable for reaction than when it comes at either one or three seconds before. But a preparatory signal two seconds beforehand does not seem to be any more favorable for the execution of the movement than when it comes at one or three seconds before the stimulus for reaction.

6. SERIES TAKEN WITH AN IRREGULAR OR NO PREPARATORY SIGNAL.

The difficulty under which the attention labors in preparing for a reaction when the preparatory signal comes at one or three seconds beforehand, is certainly slight if compared with the strain of keeping in readiness for reaction when the warning signal is given at irregular intervals or not at all. At the end of such a series of experiments there is a feeling of relief which is indicative of the strain under which the attention was laboring. Previous investigators have found that the efforts of a subject to keep his attention focused were not successful and that the time of reaction was considerably lengthened. But will this condition of mental strain have the same effect on the movement time? In considering this problem we must remember that we are dealing not only with a disturbance of the attention, but also with a stimulus arising from the mental effort to keep the attention focused. The disturbance we may consider as negative, for the conditions are merely unfavorable to concentration of the attention. Nothing positive is done to distract the subject. He endeavors to make up for the lack of a warning signal by increased efforts to focus his attention. What will be the effect of this mental activity on the movement time?

SUBJECT A.

Series I. Preparatory Signal 4½ Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
167	25	9	114	1	7

Series II. No Preparatory Signal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
286	76	7	107	4	7

SUBJECT B.

Series I. Preparatory Signal 4½ Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
141	19	12	94	3	12

Series II. Preparatory Signal None.

Reaction.	M. V.	No.	Movement.	M. V.	No.
210	20	11	88	2	11

Series I. Preparatory Signal None.

Reaction.	M. v.	No.	Movement.	M. V.	No.
172	12	26	91	3	27

Series II. Preparatory Signal 2 Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
148	11	14	90	2	14

Series I. Preparatory Signal 2 Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
134	12	14	97	2	12

Series II. Preparatory Signal None.

Reaction.	M. V.	No.	Movement.	M. V.	No.
178	20	25	95	5	23

Series I. Preparatory Signal None.

Reaction.	M. V.	No.	Movement.	M. V.	No.
196	41	19	75	4	21

Series II. Preparatory Signal 2 Seconds.

Reaction.	M. V.	No.	Movement.	M. V.	No.
158	20	16	80	4	17

Series III. Preparatory Signal None.

Reaction.	M. V.	No.	Movement.	M. V.	No.
209	29	40	79	12	41

SUBJECT D.

I. Preparatory Signal 4½ Seconds.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
	162	40	13	112	6	13
	146	10	11	118	4	11
Serial Means,	154	25		115	5	

II. Preparatory Signal Irregular, 1 Second to 1 Minute.

	Reaction.	M. V.	No.	Movement.	M.V.	No.
	278	50	10	114	4	10
	232	38	9	110	6	9
	272	54	8	113	3	8
Serial Means,	261	47		112	4	

In the results just tabulated we notice an evident lengthening of reaction time when no preparatory signal is given. The mean variation for the reaction time without preparatory signal was generally larger than that of the normal series. These results do not altogether agree with the position taken by Wundt. Quoting the work of Dwelshauwers, he says: "When the stimuli are given without preparatory signal, the greater or less endeavor to strain the attention has its effect indeed upon the length, not upon the regularity of the reaction."[1]

As to the movement time, it is clear that it is not affected to such an extent as the reaction time. And, furthermore, whatever effect there may be upon it is not in the same direction. For in the series without preparatory signals the movement times were somewhat quicker than in the normal series. This quickening, however, was slight — less than one hundredth of a second. And though it could scarcely be considered to prove conclusively that the strain of attention acted as mental stimulus which reinforced the movement, still it would be hard to account for the acceleration of the movement time on any other ground.

7. Series Taken without Any Preparatory Signal and While the Subject Was Adding.

The disturbance of the attention occasioned by omitting the preparatory signal is, as we have seen, negative in its character. It merely increases the difficulty of attending, without doing anything positive to disturb the attention. It remains to be seen what will be the effect of joining to the negative disturbance one of a positive character. Will this double disturbance lengthen the movement time, or interfere with its regularity? In order that the results may be more closely comparable with the last, it will be best to have the disturbance of an intellectual rather than a sensory kind. For, as we have seen, the increased effort of the subject to strain his attention may have acted as a mental stimulus to the movement. Is it true, as M. Féré thinks,[2] that mental activity will increase the immediate output of muscular energy?

But here we are concerned with the effect of disturbances of the attention on reaction time and movement time, rather than the reinforcement of the movement by various stimuli. This latter problem will be given special attention further on. But the two questions have points in common, and in investigating one it becomes necessary to consider the other.

---

[1] 'Grundzüge der physiol. Psychol.,' 4th ed., Vol. II., p. 349.

[2] 'Sensation et Mouvement,' Paris, 1887, p. 7. 'Note sur l'influence réciproque du travail physique et intellectuel,' *Journal de l'Anatomie et de la Physiologie*, 1901, Vol. XXXVII, p. 625, ff.

A disturbance of the attention, which at the same time is of an intellectual character, can be produced when the subject is told to carry on a process of addition during a series of experiments. Subject *A* was told to add seventeen to seventeen from the beginning of the series of experiments to the end, and to try at the same time to be ready to react at the tap of the hammer. When asked afterwards what influence the process of addition seemed to have, he replied that the attempt to add did not seem to increase greatly the difficulty of keeping himself in readiness to react. Subject *B*, however, found it very difficult and disagreeable.

In the results reported below, consecutive series are grouped together. In each group there is a normal series which is to be compared with those affected by the departure from normal conditions.

In all series the preparatory signal was given two seconds before the tap of the hammer, unless otherwise noted. This remark about the normal series applies not only to this section, but also to all subsequent sets of experiments.

The series are tabulated in the order in which they were taken.

SUBJECT A.

		Reaction.	M. V.	No.	Movement.	M. V.	No.
I.		268	32	12	115	7	12
	(Normal),	175	6	10	119	5	12
II.	(Normal),	148	20	12	126	6	12
		248	20	11	114	5	11
III.		317	50	10	119	5	10
	(Normal),	180	27	10	116	5	10
IV.	(Normal),	197	17	15	106	3	15
		268	24	23	111	2	25
V.	(Normal),	164	16	13	114	4	13
		254	27	24	117	3	21

SUBJECT B.

		Reaction.	M. V.	No.	Movement.	M. V.	No.
I.	(Normal),	168	22	26	86	5	36
		341	42	26	93	9	27
	(Normal),	150	10	10	85	6	10

		366	54	10	106	11	9
II.	(Normal),	148	35	8	85	4	7
		357	80	13	113	15	13
III.		298	65	10	98	4	14
	(Normal),	166	32	8	85	4	8
		265	35	10	104	8	16
IV.		279	23	10	102	10	10
	(Normal),	156	11	10	88	6	10
		282	43	13	105	12	13

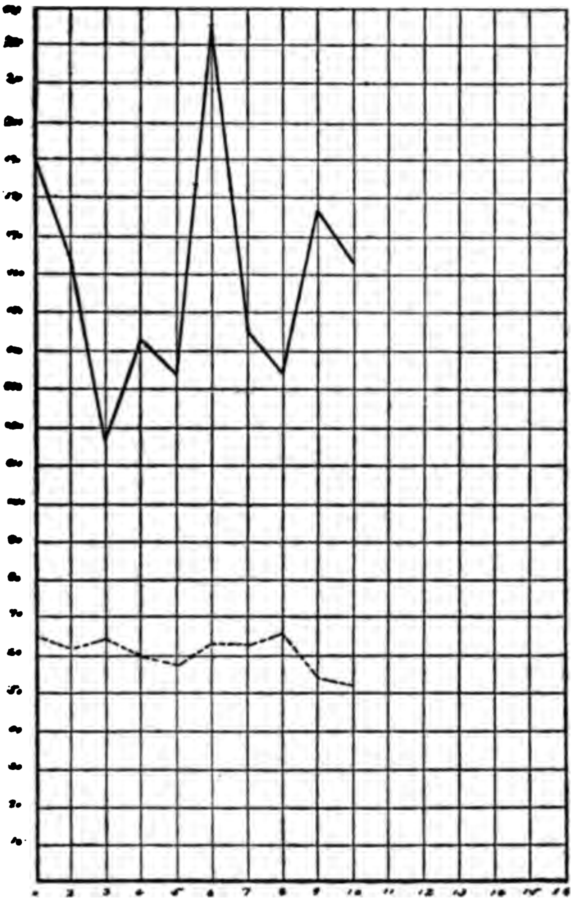


FIG. 8.

From these results it is perfectly clear that subject *B* cannot carry on a process of addition and react with as quick a movement as he is capable of making under normal conditions. But it is to be remembered that this subject found the process of addition a disagreeable as well as a difficult task. With subject *A*, who found the process but a slight source of distraction, the lengthening of the movement time is not so great nor is it constant. On two occasions his movement was quicker while adding than under normal conditions.

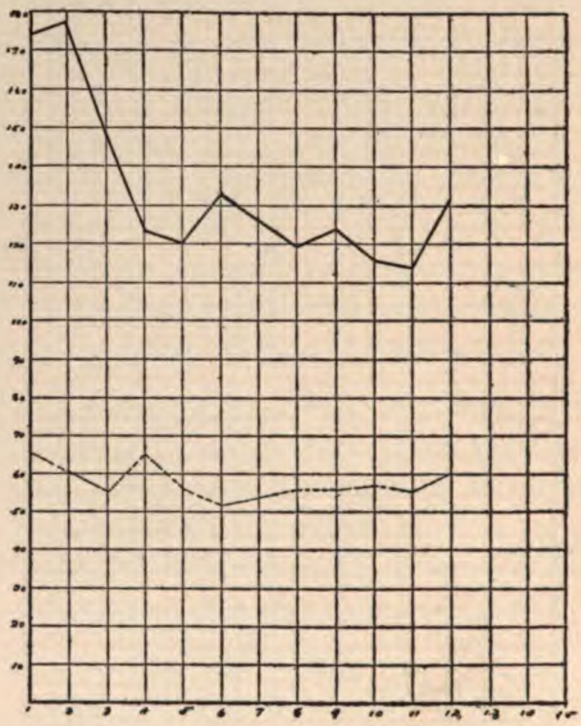


FIG. 9.

In the experiments in the previous section, where the conditions were not favorable for concentrating the attention upon the reaction and movement, it was certainly evident that the reaction time was lengthened and that the movement time was not retarded, but if anything shortened. From this we can conclude that while the attention — owing to the lack of a preparatory signal — wandered in these experiments, still the subjects were capable of maintaining the state of preparation for their maximum motor discharge in spite of the fluctuations of the attention. The experiments in this section show that with subject *B* the disturbance of the attention was certainly greater than was compatible with maintaining the state of preparation for the maximum motor discharge. With subject *A* this was generally but not always the case. The point to be noted at present — but which will be brought out more fully later — is that the state of preparation for the maximum motor discharge can be maintained in the midst of fluctuations of the attention more or less extensive.

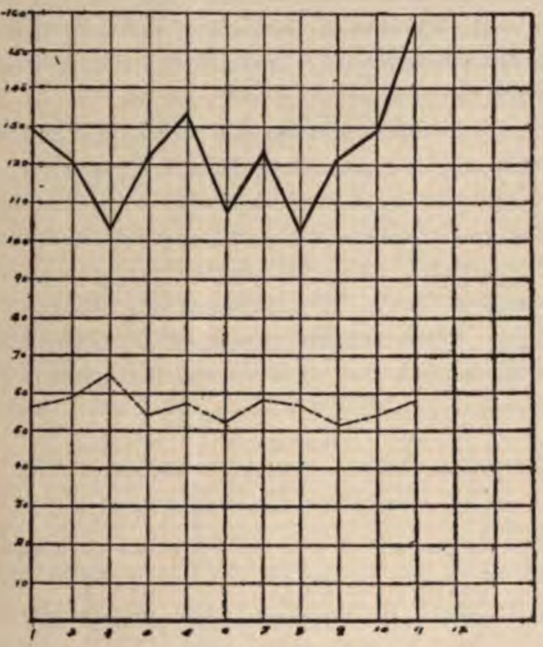


FIG. 10.

Besides the interpretation of the mean values of the experiments, it may be of interest to inquire into the variations of the individual experiments. It has been pointed out by Wundt[1] that when a very loud signal is given for reaction it sometimes seems to be of unexpected intensity, so that the subject is startled and the reaction time lengthened. Though under normal conditions we found no variation in the movement time concomitant with that in the reaction time, some such variation might be expected in series made under disturbing influences. Perhaps the shock of surprise might lengthen or shorten the movement time. At any rate, if the same set of conditions govern both the reaction time and the movement time we should expect to find that one would vary directly or inversely as the other. To bring out the relation between the individual experiments of the series, curves have been plotted out to represent the variations within each series. The continuous lines are the curves of reaction time; the dotted ones, of movement time. Numerals along the axis of abscisscas refer to the number of each experiment in its series: those along the axis of ordinates refer to time in five-hundredths of a second.

---

[1] 'Grundzüge der physiologischen Psychologie,' 5th ed., III., p. 430.

In examining the plotted curves it will appear that the longer reaction times are not always followed by shorter movement times. An increase in the reaction may be followed by either a decrease or an increase in the movement time. And reactions above the mean have movements above or below the mean of the movement time. The supposition, therefore, that the longer reaction times are due to a set of causes which also govern the movement time, finds no confirmation in the plotted curves.

8. Compound Reaction and the Speed of Subsequent Movement.

After studying some of the disturbances of simple reaction and their effect on the speed of the subsequent movement, it seems to be in place to investigate the relation between compound reaction and its movement time. Our previous experiments have indicated that increase of mental activity augmented the motor discharge of reaction. If, now, we make it necessary for the subject to perform one or more psychic acts between the signal for reaction and the execution of the movement, what relation will exist between the time of reaction and of movement? Will the movement time maintain its normal constancy? Will the interpolated process reinforce or tend to inhibit the subsequent movement?

The compound reaction selected for this test was that of choice between a movement and no movement. This kind of reaction is indeed simpler than that of choice between two movements. But the more complex form has not always been found to be the longer one.[1] In this form of reaction it is necessary for the subject to perceive the difference between two signals, and choose to react or not. If he chooses to react, these processes of distinction and choice must intervene between the time of hearing the signal and the muscular response.

In order to make this series of experiments, a second signal was arranged which gave a tap differing in sound from the previous stimulus for reaction. The new sound was made by letting the armature of an electromagnet fall about five millimeters on a piece of sheet-iron, forty-five centimeters square, supported on four brass legs about fifteen millimeters high. This piece of sheet-iron was used in other experiments for giving a very loud signal. The tap made by the fall of the armature was not, however, loud, but perfectly distinct. The electromagnet was worked by an independent circuit. To break this current a contact-breaker could be substituted at will for the metal bar on the time-sense apparatus above described. The signal not to react was produced by the new arrangement. The signal to react was given as in the previous experiments.

SUBJECT A.

		Reaction.	M. V.	No.	Movement.	M. V.	No.
I.		296	58	8	98	3	9
	(Normal),	156	11	11	106	4	12
II.		278	29	9	104	3	13
	(Normal),	166	26	9	115	5	9
III.		215	43	8	113	7	9
	(Normal),	159	14	11	112	14	10
		212	55	12	118	6	12
		SUBJECT B.					
I.		294	60	9	104	8	12
	(Normal),	155	11	12	90	4	13
II.		297	51	9	95	11	7
	(Normal),	165	11	11	86	3	11
III.		381	71	10	85	4	11
	(Normal),	155	15	13	77	3	13
IV.		319	66	10	96	6	10
		328	76	10	99	6	10
	(Normal),	171	28	12	87	3	13

---

[1] Cf. Wundt, 'Grundzüge der physiologischen Psychologie,' 5th ed., III., p. 461.

In examining these tables it will be found that for Subject *B* the mean value of the movement time was always several thousandths of a second longer when it comes as the result of a compound reaction. The corresponding mean variation is also lengthened. For Subject *A* this result occurs only in the last group of series reported, and then the lengthening is but slight.

I. SERIES IN WHICH SUBJECT B WAS DIRECTED TO GIVE THE GREATER SHARE OF HIS ATTENTION TOWARDS REACTING WITH A QUICK MOVEMENT.

		Reaction.	M. V.	No.	Movement.	M.V.	No.
I.	(Normal),	109	8	12	103	3	12
II.		220	24	22	98	2	24
I.		199	40	26	93	2	26
II.	(Normal),	130	14	10	95	3	11
I.	(Normal),	143	16	11	94	4	11
II.		195	60	19	95	3	20
I.	(Normal),	105	9	10	102	1	9
II.		185	49	25	101	3	26

(From four to seven erroneous reactions occurred in each series of compound reactions.)

II. SERIES IN WHICH SUBJECT B WAS INSTRUCTED TO TAKE CARE TO REACT ONLY TO THE RIGHT SIGNAL; BUT AT THE SAME TIME TO MAKE THE QUICKEST POSSIBLE MOVEMENT.

		Reaction.	M. V.	No.	Movement.	M. V.	No.
I.	(Normal),	114	10	12	96	3	12
II.		227	40	29	96	2	29
I.		269	48	25	92	1	25
II.	(Normal),	123	7	11	98	4	11
I.	(Normal),	141	16	11	93	3	11
II.		256	26	10	92	2	10
I.		219	36	28	93	2	28
II.	(Normal),	158	16	12	95	13	5

(In the first part of three of these series of compound reactions the subject made one erroneous reaction, but was immediately warned. After the warning each series was completed without another error.)

The compound reaction time for Subject *B* was longer than that for Subject *A*. This suggested the supposition that perhaps Subject *B* paid such attention to waiting for the signals that he did not exert his maximum effort to make the quickest possible movement. Accordingly, it was decided (1) to take several series for this subject in which he was directed to pay more attention towards reacting with a quick movement than taking care to react only to the proper signal, and then (2) to direct him to take care not to make any mistakes, but at the same time to react with the quickest possible movement. The results are given above.

We have here results obtained from two methods of directing the attention in a compound reaction. If the attention is directed towards making a rapid movement the reaction time is quicker than when the subject directs his attention to the signal, *i. e.*, takes care to make no mistakes. The compound reactions made under these conditions appear to have some analogy to the muscular and sensorial simple reactions. But when the subject is told to give the greater share of his attention towards making a quick movement there is scarcely a full compound reaction. The process of choice is perhaps eliminated and we have in the greater part of the series a full sensorial reaction. But when the subject is told to take care tha the make no mistakes we have a true compound reaction with a complete process of choice interpolated.

As to the movement time there is but little difference in the two sets of experiments. In both the time of movement is usually a little quicker for compound reactions than for those made under normal conditions. It seems that the slight increase of mental activity demanded for the compound reaction acted as a stimulus which slightly reinforced the motor discharge. This result agrees with those obtained with Subject *A*, but is a reversal of the results first obtained from Subject *B*. The compound reaction times in Subject *B*'s last two sets of experiments are shorter than in his former. The most probable explanation of these facts is that in his first set of experiments Subject *B*'s attention was so exclusively turned towards the signal for reaction that he did not take the proper care to make the movement as quick as possible. If this be true, then we have in the first set of experiments from Subject *B* something like a sensorial compound reaction and in the second set a muscular compound reaction.

9. RELATION BETWEEN THE MOVEMENT OF REACTION AND AN INDEPENDENT VOLUNTARY MOVEMENT.

All the movements measured in the preceding series of experiments were the immediate result of responding to the stimulus for reaction. The chain of connection between the ear and the muscles concerned in the movement was in some manner prepared by a voluntary act which preceded the stimulus for reacting. In those reactions that were muscular it will generally be admitted that no new act of the will intervened between the stimulus for reaction and the movement. In the sensorial reactions (*e. g.*, those made without any preparatory signal) there was at least some preparation for the movement, by a previous act of the will, before the stimulus was given. Perhaps there might be some difference in the time of movement when it arises as the immediate result of a voluntary act and not in response to a stimulus. To test this point the subject was told that, on hearing the signal, he should wait a short time and then, after resolving to make the quickest movement he could, execute it to the best of his ability. In this way a movement was secured which came as the immediate result of a voluntary act. Consecutive series were taken of the voluntary movement and of the reaction and its movement. As usual we have grouped the consecutive series together in reporting the results below.

SUBJECT A.

		Reaction.	M. V.	No.	Movement.	M. V.	No.
I.					115	8	24
	(Normal),	137	23	11	113	5	14
	(Normal),	145	14	10	113	4	10
					106	6	22
	(Normal),	123	14	10	117	5	14
					117	5	14
					118	10	13
II.					114	8	39
	(Normal),	159	18	10	112	4	11
					116	4	25
III.					107	5	24
	(Normal),	163	26	11	102	5	13

SUBJECT B.

		Reaction.	M. V.	No.	Movement.	M. V.	No.
I. Prep. Signal 4½ s.							
	(Normal),	117	9	8	100	6	8
					110	8	8
II. Prep. Signal 4½ s.							
	(Normal),	133	12	10	96	3	10
					88	3	16

III. Prep. Signal 4½ s.						
				89	1	6
(Normal),	161	46	12	91	3	12
				93	0.5	4
IV. Prep. Signal 4½ s.						
				90	3	10
	136	12	10	95	3	10
				93	3	10
V. Prep. Signal 2 s.						
				92	5	27
	113	26	13	95	4	13
				95	4	16

When we examine these results it seems perfectly clear that with Subject *B* the speed of what may be called the purely voluntary movement cannot be said to be constantly quicker or slower than that made in response to the signal to react. The variations lean now a little to one side and now to another. The mean deviation from the normal (without regard to plus or minus signs, of course) is four thousandths of a second. With Subject *A*, however, it must be noted that the normal was quicker by several thousandths of a second, except in one case, when the voluntary movement was seven thousandths of a second quicker than the preceding normal, and four thousandths of a second quicker than the succeeding normal. The mean deviation from the normal for this subject is five thousandths of a second. It may be noted that with Subject *B* the tendency towards a muscular reaction is stronger than with Subject *A*.

The conclusion that we are justified in drawing from these results is that no decided difference exists between the time of a movement made in reaction and that made by a purely voluntary act.

10. THE EFFECT OF SENSORY STIMULI ON THE TIME OF REACTION AND OF MOVEMENT.

Before presenting the results obtained in this part of the work, it will be well to give some account of the literature which bears upon the effect of various stimuli on voluntary movement.

One of the earliest and most extensive workers in this line is M. Charles Féré. The first edition of his 'Sensation et Mouvement' was published in 1887. In that work he put forward a number of conclusions at which he had arrived by means of his experiments with the dynamometer. He there published the opinion that 'momentary exercise of the mind provokes a momentary exaggeration of voluntary movements.'[1] He also found that the exercise of any group of muscles other than those used in working the dynamometer increased the force of the hand a sixth or a fifth part or even more. Speaking produced a like effect. He also studied the influence of the suggestion of a movement on subjects abnormally affected by excitatory or depressive agents. Such a subject could be made to feel a movement in his own hand and finally to execute irresistible, rhythmic flexions, merely by watching the movements of the experimenter. If, however, at the point where the subject commenced to feel the sensation of movement, his hand were placed in the dynamometer, the force of movement then registered would be a third or a half greater than the normal pressure. M. Féré concluded from these and certain other experiments that 'the energy of a movement is in relation with the intensity of its mental representation.'[2] He also found that the shorter the wave-length and the greater the amplitude of wave-length in a sound, the greater was its power to reinforce movement.[3] Similar results were found to hold good for light stimuli.[4]

M. Féré continued this line of work by subsequent researches with Mosso's ergograph. One of these pieces of work, which deals with the effect of a number of sensory stimuli, was published in 1901, in the *Journal de l'Anatomie et de la Physiologie*.[5] The method of procedure in the experiments there reported was:

1. The reaction times of two index fingers and of the left middle finger were taken.
2. Two records of pressure were taken from each hand on the dynamometer.
3. The middle finger of the left hand was placed in the dynamometer and a weight of three kilograms was lifted every second. It is not stated that each series was limited by the exhaustion of the middle finger.

---

[1] P. 7.

[2] *Op. cit.*, p. 14.

[3] *Op. cit.*, p. 34, ff.

[4] *Op. cit.*, p. 41, ff.

[5] Vol. XXXVII., pp. 1-79.

4. A rest of three minutes was allowed, during which each hand was again tested on the dynamometer. A new series was then begun and this method of procedure continued through a number of series, varying from seven to sixty.

5. At the end of the whole set the pressure of each hand was again taken, and the reaction time of the two index and the left middle fingers were again taken.

The results indicated an oscillation in fatigue throughout the various sets of experiments. The pressure of the left hand steadily diminished; but at the end of four or five series that of the right hand was often augmented. At the end of the experiment the reaction time of the two index fingers was found to be less than at the beginning; but that of the middle finger was increased. It was also found that moving the legs and counting in a loud voice reinforced the working-finger. More work could be done with the eyes open than closed, and more under the influence of red light than any other. Sounds both harmonious and discordant increased the power of working. Musk and ethereal odors, the taste of sugar, acetic acid and sulphate of quinine all reinforced the working finger. Alcohol and bouillon merely taken into the mouth increased the amount of work that could be done more than when swallowed. Tastes were found, as a rule, to reinforce the working finger more than odors, and both together operated more powerfully than either separately. Cutaneous sensations, such as heat, cold, and rubbing, had also a tonic effect.

In another article in the same volume of this magazine, M. Féré came to these conclusions: "Le travail mécanique de la main gauche est moins influencé par le travail intellectuel que le travail mécanique de la main droite. Le travail de la main gauche gagne moins quand il coïncide avec un travail intellectuel facile, il perde moins quand il coïncide avec un travail intellectuel relativement compliqué."

M. Féré has made a number of other studies in the reinforcement of voluntary muscular contractions; but it will not be necessary to summarize them here. A number of them will find mention in the bibliography. Those already reported show the general trend of his line of work.

Ludwig Hofbauer[1] found that loud raps, the slamming of a door or such sound stimuli, were too weak to make any manifest change in an ergogram. Consequently he tried the sound made by firing a revolver. The contraction recorded after such a loud report usually jutted far above those before or after it. On closer examination it was found that when the report came less than .4 of a second before the ordinary signal for contraction, the contraction was nearly always reinforced. But if a longer time intervened the contraction was somewhat lessened. When the report came from .27 to .49 of a second after the ordinary signal the contraction was reinforced. From these and other experiments made with visual and cutaneous stimuli he came to the conclusion that if the excessive stimulus comes when the attention is focused upon a movement about to be performed it reinforces the movement. But if the excessive stimulus comes before the will is prepared to act then the voluntary movement is inhibited.

Mr. Allen Cleghorn repeated the same work, confirming the results of Hofbauer, and also called attention to the fact that the relaxation following such a reinforced contraction is quicker and more complete than when no stimulus is given.[2]

Most of the literature on the reinforcement of voluntary muscular contractions is, as a rule, professedly concerned with fatigue rather than problems of reinforcement and inhibition. And, indeed, in all work with the ergograph, such as that of M. Féré, it may be questioned whether or not the sensorial stimulus directly reinforces the movement, or whether it does so indirectly by tending to eliminate one of the several factors which help to bring about fatigue. The effect of alcohol on reaction time and ergographic work has been the subject of much experimental research. Its working is, no doubt, of a much more complicated character than that of a mere sensory stimulus.

It is certainly desirable to study the reinforcement of voluntary muscular contractions under simpler conditions than those offered by the ergograph. We cannot be sure that stimuli which strengthen muscular contractions under the influence of an ever-increasing fatigue will have the same effect on single voluntary contractions when the element of fatigue is practically eliminated. The apparatus already used in these experiments affords the opportunity of studying the effects of sensory stimuli on single voluntary contractions. Not only can we study the single contractions, but also the reaction of which they are the result. And an interesting problem at once presents itself: will sensory stimuli which quicken or lengthen reaction time have the same effect on the time of the subsequent movement?

---

[1] 'Interferenz zwischen verschiedenen Impulsen im Centralnervensystem,' *Pflüger's Archiv für die ges. Physiologie*, Vol. LXVIII., pp. 546–559.

[2] *American Journal of Physiology*, 1898, Vol. I., pp. 336–345.

The stimuli which have been studied are:

(*a*) A continuous noise made by the interrupter of an induction coil.

(*b*) The noise of this induction coil plus a slight shock received by holding the electrodes in the hand. This shock was not painful.

(*c*) An intermittent sound made by a metronome beating sounds.

(*d*) A very loud signal for reaction.

To give this loud signal, some additions to the apparatus already employed were required. A hammer was pivoted so that it could fall through an angle of sixty degrees on the plate of sheet-iron mentioned above.[1] In one corner of this plate a spring made of phosphor-bronze was fastened to an insulated support. The other end could be held up from the plate of sheet-iron on an insulated latch. When the hammer fell, it drove the spring down upon the plate of sheet-iron, giving at the same time, as a signal for reaction, a single loud report. An electric contact was thereby established through wires running from the metal plate and the spring. This contrivance was substituted for the electromagnetic sound-hammer in the circuit above described.[2] The hammer which fell on the metal plate could be held in an almost upright position by means of an electromagnet. Breaking this circuit let the hammer fall until it hit the spring. The plate of sheet-iron rested on a wooden box, which served as a sounding-board. Its level being somewhat above that of the hammer's pivot, the extent of the swing was limited to about sixty degrees.

---

[1] P. 41.

[2] P. 14 ff.

It was found necessary to introduce this spring for making an electric contact with the plate, rather than to have it established directly through the hammer. The first experiments were made by the latter method; but the rebound of the hammer falling through so great a distance falsified the results of the reaction time. These early series, however, are published below, the reaction time for the loud signal being omitted. The time of movement, however, could not be effected by the rebound of the hammer, for the contact must be made by the time the subject commences to react, or no record at all is obtained.

The results are divided into sections. The effect of the sound of the induction coil and the shock were studied together and form a single section.

Section A. The effect of a continuous sound and of a continuous electric shock on reaction time and movement time.

SUBJECT A.

Series I. Disturbance Caused by the Sound of an Induction Coil.

Reaction.	M. V.	No.	Movement.	M. V.	No.
202	36	9	125	4	10

Series II. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
164	18	13	120	5	14

Series III. Disturbance Caused by the Sound of an Induction Coil and a Continuous Shock.

Reaction.	M. V.	No.	Movement.	M. V.	No.
177	23	12	127	11	13

Series IV. Same as Series I.

Reaction.	M. V.	No.	Movement.	M. V.	No.
162	11	13	116	6	13

Series V. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
146	17	14	112	5	14

Series VI. Same as Series III.

Reaction.	M. V.	No.	Movement.	M. V.	No.
166	18	10	119	4	11

SUBJECT A.

Series I. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
168[1]	20	12	110	6	13

Series II. Disturbance Caused by the Sound of an Induction Coil.

Reaction.	M. V.	No.	Movement.	M. V.	No.
169	9	9	114	6	12

Series III. Disturbance Caused by the Sound of an Induction Coil and a Continuous Shock.

Reaction.	M. V.	No.	Movement.	M V.	No.
173	18	13	120	6	13

Series IV. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
160	14	12	111	4	12

Series V. Same as Series II.

Reaction.	M. V.	No.	Movement.	M. V.	No.
166	17	12	114	7	13

Series VI. Same as Series III.

Reaction.	M. V.	No.	Movement.	M. V.	No.
172	13	12	125	3	13

SUBJECT B.

Series I. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
145	16	13	84	6	13

Series II. Disturbance Caused by the Sound of an Induction Coil.

Reaction.	M. V.	No.	Movement.	M. V.	No.
179	17	12	84	3	13

SUBJECT C.

Series I. Disturbance Caused by the Sound of an Induction Coil.

Reaction.	M. V.	No.	Movement.	M. V.	No.
164	17	12	87	4	13

Series II. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
151	18	13	83	4	13

Series I. Disturbance Caused by the Sound of an Induction.

Reaction.	M. V.	No.	Movement.	M. V.	No.
169	11	12	98	7	12

Series II. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
156	17	13	117	7	12

Series III. Disturbance Caused by the Sound of an Induction Coil and a Continuous Shock.

Reaction.	M. V.	No.	Movement.	M. V.	No.
172	8	12	113	8	13

---

[1] A very long reaction (266) if excluded here would bring this mean down to 159.

SUBJECT D.

Series I. Disturbance Caused by the Sound of an Induction Coil and a Continuous Shock.

Reaction.	M. V.	No.	Movement.	M. V.	No.
212	45	10	105	8	9

Series II. Disturbance Caused by the Sound of an Induction Coil.

Reaction.	M. V.	No.	Movement.	M. V.	No.
162	12	12	100	2	12

Series III. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
191	26	12	97	6	13

Series IV. Same as Series I.

Reaction.	M. V.	No.	Movement.	M. V.	No.
232	34	14	103	3	14

SUBJECT D.

Series I. Normal.

Reaction.	M. V.	No.	Movement.	M. V.	No.
170	16	13	93	7	13

Series II. Disturbance Caused by the Sound of an Induction Coil.

Reaction.	M. V.	No.	Movement.	M. V.	No.
165	13	13	95	3	13

Series III. Disturbance Caused by the Sound of an Induction Coil, and Continuous Shock.

Reaction.	M. V.	No.	Movement.	M. V.	No.
173	16	12	95	4	12

Section B. The Effect of an Intermittent Sound on Reaction Time and Movement Time.

The intermittent sound, as we have said, was caused by a metronome beating sounds.

SUBJECT B.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
(Normal),	158	39	8	89	3	8
	166	28	11	91	3	11
(Normal),	164	30	9	93	3	8

SUBJECT D.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
(Normal),	148	16	12	104	5	12
	240	30	9	112	4	11
	190	20	12	111	4	13
(Normal),	164	27	12	113	4	12
	179	20	11	105	3	13

Section C. The Effect of a Loud Signal for Reaction.

SUBJECT A.

	Reaction.	M. V.	No.	Movement.	M. V.	No.
I.	154	19	26	99	5	24
(Normal),	129	16	9	104	2	10

II.	153	19	34	106	3	25
(Normal),	180	27	10	121	5	11
	166	32	26	101	6	27
	158	17	38	98	4	37
		SUBJECT B.				
				80	4	12
(Normal),	147	14	11	98	5	12
				100	4	12
(Normal),				93	1	18
		SUBJECT C.				
				90	4	10
(Normal),	142	14	13	102	4	13

In examining these results it seems clear that when a sensory stimulus was given continuously during a series of experiments the reaction time was usually lengthened. This was most evident when the subject heard the sound of an induction coil, and also felt the shock by holding the electrodes in his left hand. The lengthening of the reaction time due to the sound of the coil alone was generally less than that caused by both the sound and the shock together. The effect on the movement time was not so marked; but it seemed that a continuous sensory stimulus tends to lengthen the time of movement. And, as a rule, the lengthening of the movement time — as of reaction time — was greater for the two disturbances than for one alone.

The effect of the intermittent sound was to lengthen reaction time, but no effect on the movement time could be ascertained. The meaning of this is that the intermittent sound acts merely as a disturbance of the attention.

The effect of the loud signal for reaction was without exception to quicken the time of movement. Its effect on the time of reaction was not constant.

11. THE GRAPHIC CURVE OF THE MOVEMENT.

A complete study of the movement of reaction should give us not only the absolute time of the movement and its variation in a series of experiments, but also the variation in the speed movement throughout its entire course. Does the movement start with a maximum velocity and then gradually decrease? Or is the speed constantly accelerated? Does it vary irregularly? The best way of solving this question is of course to get

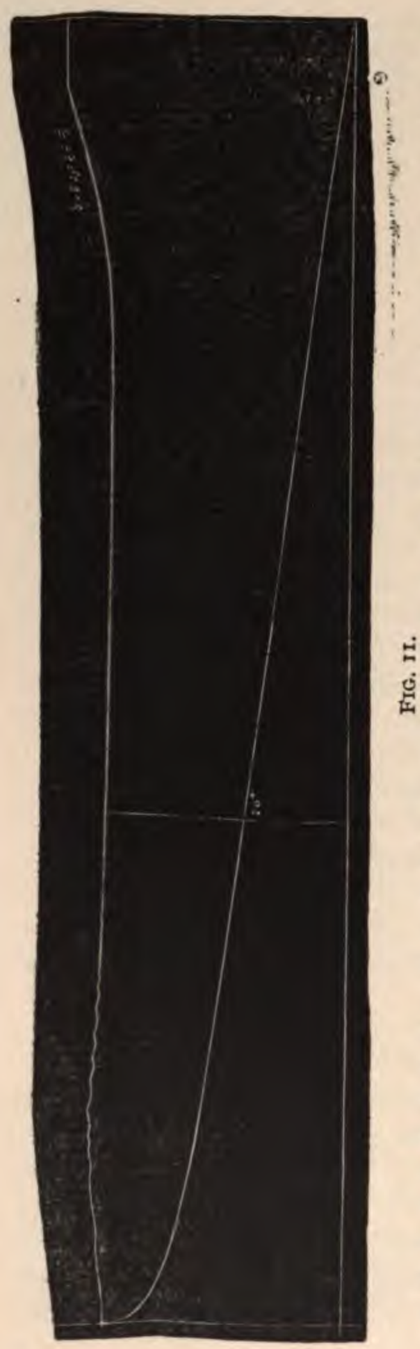


FIG. 11.

a graphic curve by which the movement will be represented in coördinates of time and space. To obtain this curve the following apparatus was used. A piece of heavy steel wire 104 cm. long and 2.1 mm. in diameter was arranged to run through two eye-holes, one in each of two brass rods supported on stands, beside the drum of a chronograph. This drum was 35.5 cm. long and 16 cm. in diameter. In the middle of the rod of steel wire a brass marker was soldered, which reached over to the top of the drum. The brass rods which supported the steel wire were so arranged that it ran through the eye-holes without friction, in a line parallel to the axis of the drum. When the drum was at rest and the steel rod was drawn through the eye-holes, it made of course a perfectly straight line along the top of the drum. When, however, the drum was in motion, a curve was drawn which varied with the speed of the drum and the rate at which the wire passed through the eye-holes. The speed of the drum, however, was nearly constant, and with the gearing and weights used it made sixty revolutions a minute. Through a small eye-hole in the end of the wire, a heavy linen thread passed through pulleys to the lever which the subject moved in making the movement. To the other end of the wire a long, loosely wound steel spring was attached and passed backward to the wall. This served to keep the linen thread taut and make the wire follow the movement of the arm, whether it moved fast or slowly, backwards or forwards. Its pull against the arm, however, was too slight to have any appreciable effect on the movement. The drum being in motion, a graphic curve was obtained of whatever movement was made with the lever. A sample curve is here reproduced (Fig. 11).

In examining this curve, we find that during the first part of its course it is concave to a line drawn from the starting-point of the curve with the drum at rest. This shows that during this part of the curve, the movement was accelerated. It passes, however, into an approximately straight line before reaching the end of twenty degrees. This shows that at the point of transition the speed of movement attains its maximum and after this remains almost constant.

A number of curves were taken with the drum moving at a slower rate of speed, to see if the 'antagonistic reaction' noticed with some persons by Mr. Smith[1] would be found in the movements of our subjects. Only Subject *A* knew beforehand the purpose of the experiments. In these experiments the starting-point was a little away from the post to allow for any possible antagonistic movement. Though the slightest backward movement would have been recorded on the drum, no 'antagonistic reaction' was found for our subjects.

SUMMARY.

The empirical conclusions thus far reached may be summarized as follows:

1. When the subject is told to react as quickly as possible but nothing is said about the movement of reaction, whether it is to be fast or slow, there is no fixed relation between the reaction time and the movement time. The variations in one seem to be independent of those in the other.

---

[1] Cf. *supra*, p. 3.

2. When, however, the subject is told to react as quickly as possible with the quickest possible movement, the time of movement is practically constant, but the reaction time may vary considerably.

3. The idea of making the quickest possible movement has a tendency to make the subject react in the muscular manner.

4. There is no constant relation between the slight variations in reaction time and the larger variations in the movement time, or, in other words, the slower movements do not correspond to the longer reactions, nor do the slower movements correspond to the quicker reactions.

5. With some subjects this comparative constancy in the movement time is attained with little or no practice.

6. Varying the preparatory signal in successive series from one to three seconds causes the reaction time to change, but does not seem to affect the movement time.

7. When no preparatory signal at all is given, and when it is given at irregular intervals, the reaction time is considerably lengthened. The movement time is not lengthened, however, but is if anything a little shorter.

8. The disturbance of the attention caused by having the subject carry on a process of addition is in general greater than is compatible with executing the quickest possible movement.

9. In compound reactions, when the subject had to choose between a movement and no movement, the movement was generally quicker than in the normal simple reaction.

10. An exception was pointed out to the above conclusion which indicated also that the length of a compound reaction varies according to the direction of the attention.

11. There seems to be no considerable difference in time between a purely voluntary movement and that made in response to a stimulus for reaction.

12. The effect of a continuous noise made during a series of experiments by the interrupter of an induction coil was to lengthen the reaction time, and also to a slight extent the movement time.

13. The effect of this same noise plus a slight shock, received by holding the electrodes in the left hand, was to lengthen

still more the reaction time. In like manner, the movement made under the influence of two disturbances was as a rule slower than that executed during a single disturbance.

14. The effect of an intermittent sound, made by a metronome beating seconds, was to lengthen the reaction time, but there was no apparent effect on the movement time.

15. A very loud signal for reaction was followed by a quicker movement than that of reactions made with the usual tap of the hammer.

VI. THEORETICAL INTERPRETATIONS.

The conclusions we have just laid down are the condensed expression of the facts obtained in a number of experiments. It remains now to see what bearing they may have on questions of a more general character.

1. THE PHYSIOLOGICAL INTERPRETATION OF CONSTANCY OF THE MOVEMENT TIME.

The first point which strikes our attention in these results is the variability of reaction time and the constancy of the movement time. In one and the same series the reaction time undergoes considerable change, but the movement time is fairly constant. If you introduce factors which increase the difficulty of attention, the reaction time is lengthened and rendered still more variable, but the time of movement remains about the same. Disturbances of the attention (within certain limits), therefore, lengthen reaction time but do not affect the speed of subsequent movement. If, now, we can find by what processes of reaction the movement is determined, we can argue that they are not affected by the fluctuation of the attention.

It is clear that the velocity of the movement is determined by the intensity of the motor discharge received in the muscles. Following this discharge back, we find that it is determined by the discharge of the root-cells in the grey matter of the spinal cord. Tracing the nervous impulse still further, it seems probable[1] that it received a certain amount of coördination in the bulb, to which it came from some higher center. And as we shall see later, this higher center is most likely the cortex. Constancy in the speed of movement would therefore be dependent upon constancy in the discharge of root-cells, invariably the same distribution in the bulb, and constancy in the discharge of the cortical cells. If we found that the speed of movement was lengthened by a disturbance of the attention, we might infer — at least as far as logic is concerned — that either the cortical cells or the bulb or the root-cells of the spinal column were affected by the disturbance of the attention. For a slower movement would be due either to a weaker discharge of cortical cells or spinal root-cells, or to an improper distribution in the bulb, by which some of the discharge would be dissipated along the wrong paths. Since, however, in spite of the disturbances of the attention, the speed of movement remains constant, we must suppose that cortex, bulb and root-cells continue to function just as they do under normal conditions.

---

[1] Cf. Foster, 'A Text Book of Physiology,' 5th ed., New York, 1890, Part III., Section VI.

Now, this might be explained in two ways. In the first place, we might suppose that the disturbance of the attention actually does result in a relaxation of the maximum motor discharge. But before making the movement, the attention of the subject was again focused upon the idea of making the quickest possible movement and then by a new act of the will his maximum motor discharge was again prepared and sent forth to the muscles.

But against this view may be urged the conclusion from one set of experiments in compound reaction. In these experiments a choice was to be made between a movement and no movement. It was found that while the subject endeavored to react with the quickest possible movement, he executed a slower movement than in a normal simple reaction. The idea of not making a movement most likely brought about a relaxation of the preparation for the maximum discharge. A new act of the will was undoubtedly present in this compound reaction to execute the quickest possible movement; but it seems to have failed to do so. And there seems to be no reason to expect that after a disturbance of the attention the subject would, as it were, wait to re-establish the best conditions for a rapid movement and then execute it. Another idea also would be present in consciousness: to start as soon as possible. Without waiting for any complicated process to take place, the subject would react at once and make the movement — as in the set of compound reactions referred to — as best he could under the conditions. The processes of a new act of the will and re-preparation of the motor discharge complicate the process of reacting too much. Some simpler explanation is probably the truer expression of what really takes place.

The other hypothesis which might be offered is that the subject can maintain the state of motor tension for the movement in the midst of such wanderings of the attention as occur when no preparatory signal is given and sometimes even while the attention is employed in such a process as addition. Of course a complete state of inattention would excessively lengthen the reaction time, during which period the maximum motor discharge might or might not be prepared for the execution of the movement.

However, the attention was by no means completely distracted during these series of experiments. Its wanderings were comparatively slight and we may say insufficient to disturb the motor preparation for the quickest possible movement. The central disturbance resulted in a lengthening of reaction time which was due to changes in the central stations or perhaps in the afferent paths. That the efferent path from cortex to muscle is not affected by the disturbance of the attention and that reaction time is not lengthened by any changed conditions along this path, seem to be the conclusions warranted by the fact of constancy in the time of the movement by which the reaction was executed. But can we apply the latter conclusion to reactions where there is no attempt to make the quickest possible movement? Have we not found that in such reactions the time of movement varies? But the variations in the time of movement when the subject does not try to make it fast or slow, are due to the varying intensity of discharge which the motor center happens to send forth — not of course to any varying resistance in the efferent paths. And there seems to be no reason to suppose that in one case attention would affect the efferent paths and in the other case it would not. Nor should we expect a lengthening of reaction time in the efferent circuit. The axones of the motor cells in the cortical area pass down through the pyramidal tract to the root-cells in the spinal cord without stopping at any relay station in their course. Once a motor discharge is sent forth it is hard to see how any delay could be experienced owing to a previous disturbance of the attention. With the efferent circuit, however, matters are different. The path is made up of several superimposed neurones. And one could easily imagine that if the subject were not expecting the signal for reaction the connections between these neurones might be interfered with so that the stimulus would be delayed in its path to the center.

2. PHYSIOLOGICAL INTERPRETATION OF THE VARIATIONS OF THE MOVEMENT TIME UNDER THE INFLUENCE OF SENSORY STIMULI.

If it be true that a mere disturbance of the attention does not interfere with the motor processes of reaction, then it must be admitted that the sensory stimuli, which seemed to lengthen the movement time as well as the reaction time, were probably more than mere distractions of the attention. It would seem that a continuous noise during a series of reactions in some manner either lessened the amount of potential energy at the disposal of the motor center or antagonized the maximum motor discharge after it has passed outward to the muscles. Perhaps the truest expression of what happened is that the sensory and motor centers are so closely connected that the motor center cannot do its maximum work while the sensory is continuously employed. In those experiments where the sound of the induction coil or the shock of the electrodes or both acted as disturbing influences, certain sensory centers were continuously at work throughout each series. This is one fact. The second is that the maximum discharge of the motor center was lessened. The supposition just suggested seems to be the mere statement of these two facts in theoretical terms. The only possible objection arises from the alternative already mentioned. Perhaps the center of the discharge is not interfered with at all. The sensory discharge flows over into a motor discharge which antagonizes that of the motor center for the movement. But why should that discharge be an antagonistic discharge? Why should it not flow along paths already open, and reinforce the movement? M. Féré found that working a set of muscles other than that employed on the ergograph reinforced the working finger. It is indeed hard to see why the motor discharge accompanying the continuous operation of the cutaneous and auditory centers should have an antagonistic effect upon the outward rotation of the arm, unless these centers were in some way closely connected with the muscles which give the humerus an inward rotation — a supposition for which there is no ground whatsoever.

It would seem more probable, therefore, to say that a continuous operation of the cutaneous and auditory centers lessens the amount of potential energy at the immediate disposal of the motor center for the arm.

The reinforcement of the movement by the loud signal for reaction is not against this view of the matter but brings out more clearly the close connection between the sensory and motor areas. When the subject is waiting to respond to the signal to react, we can readily suppose that the connections between the sensory and motor areas are already prepared. When the incoming stimulus is very loud, the auditory center is discharged with great force. The extra energy thus liberated passes over to the motor center, discharging it more forcibly and producing a quicker movement. The signal for reaction is necessarily associated with the motor area for the movement. We should therefore expect that the louder signal would reinforce the motor area. But the sound of the induction coil or the shock of the electrodes are not in any way associated with the movement. The sensory discharge of those centers does not therefore reinforce the motor area for the arm, but by maintaining a state of neural tension in the sensory cells in some manner lessens the maximum tension in the motor cells.

3. Bearing of Experiments on Professor Münsterberg's Action-Theory.

While one may admit that (as our experiments seem to prove) sensory and even intellectual representative processes have a tendency to flow over into movement, still it would be a further and bolder step to say that consciousness is absolutely dependent on the possibility of a motor discharge. One might with perfect logic admit the former and deny the latter as a conclusion too broad for the present basis of facts. The theory that consciousness is absolutely dependent on the possibility of a motor discharge is associated with the name of Dr. Münsterberg. He has outlined his position in the last chapter of his 'Grundzüge der Psychologie.' The above discussions of the relations between the fluctuations of attention and the motor discharge in reaction are suggestive of certain objections which it may not be out of place to mention. But before doing so it will be necessary to give some account of the peculiar theory of which Professor Münsterberg may be regarded as the author, although in many of its features it is not new.

(*a*) *Outline of the Theory.*

Professor Münsterberg has called his explanation of consciousness the action-theory, because it makes use of motor processes in accounting for psychophysical phenomena. Previous theories have contented themselves with centripetal processes; the action-theory makes use of the centrifugal processes as well. According to the association-theory the orientation of consciousness (Stellungnahme) is dependent on purely psychical functions; but Dr. Münsterberg considers as fundamental the motor functions of the brain and even real actions of the organism. The new theory boasts of no recent physiological discovery as its protector. It hopes to win adherents on the field of battle. It starts out from the well-known facts of vividness and penetration, of reinforcement and inhibition, of furtherance and suppression, and associates with these the physiological processes of centrifugal action. To a certain extent it accords with the older theory of association. It admits that the quality of sensation is determined by the efferent path, and the quantity by the intensity of the incoming stimulation. But to explain its peculiar accompanying characteristics (Wertnuance) and the liveliness with which it affects consciousness, Dr. Münsterberg calls into his service the motor side of the process.

The very condition for any psychophysical phenomenon is the possibility of a motor discharge. When the afferent stimulus flows over into an efferent discharge it awakens consciousness to action. And it is this very act of passing which makes the subject conscious. If the proper motor discharge were completely blocked, stimulus after stimulus might impinge upon the organ of sense and be carried to the brain, and still the subject would know nothing of the afferent process. That we may not be able to notice any motor disturbance as a result of conscious processes is no conclusive argument against the theory. Plethysmographic researches have pointed out the connection between psychophysical work and changes in blood volume; and the study of the knee-jerk has shown how remarkably the reflex centers are dependent on states of consciousness.

Turning to physiology for a closer view of motor processes, it is found that the cortex does not send its impulse directly to the muscle, but first acts upon certain subcortical centers. These in their turn may transmit the impulse to medullar ganglions. On this position of physiology the action-theory finds a foothold, and lays down the further statement that each subcortical motor center is connected with an antagonistic center. No central motor impulse is known which is not associated with an antagonistic discharge. The typical example of this is the relation between the muscles of flexion and extension. All antagonistic functions of the nervous system, all reinforcement and inhibition, rest upon this opposition of actions. "But there is no psychophysical event which as such is opposed to another psychophysical event, there are no two ideas which, as psychical images, exclude each other. There are no two sensations in whose very nature it lies that they cannot be simultaneously present in consciousness."[1]

It is on this account that any attempt to explain the phenomenon of reinforcement and inhibition from the relation between sensory processes is preordained to failure. "There is but one opposition, that which is based upon mechanical necessity. We cannot perform one action and at the same time execute the antagonistic, we cannot at the same time go to the right and the left, we cannot simultaneously raise and lower the eyes, we cannot at the same time breathe in and out, we cannot at the same time stretch out our hand and draw it back, in brief, only an action has its antithesis — an idea never; only an action can

[1] 'Grundzüge der Psychologie,' Vol. I., p. 534.

never be performed unless an antagonistic movement is thereby excluded; while any psychophysical stimulus can in itself be united with any other, no physiological reason can be found in the very nature of such a stimulus which makes the suppression of a coördinated sensory stimulus a necessity." The very foundation of the action-theory is based upon this conception. Sensations are lively and forcible when the sensory stimulus finds no resistance along the path of its discharge. But whence comes this resistance? From antagonistic motor centers. If the sensory stimulus passes over into the paths leading to a subcortical motor center, which is itself inhibited on account of a stimulus proceeding from the antagonistic center, the motor discharge meets with resistance. The reciprocal action of antagonistic centers accounts for the continuous play of reinforcing and inhibitory forces on the field of consciousness.

The action-theory is independent of any microscopical investigations in anatomy. It transcends them and rests upon an altogether higher plane. If metaphysics is only well founded, there can be no doubt that physiology and anatomy will, in time, suit their facts to the theories. But the action-theory can, with equal facility, fit into any of the more special hypotheses of nerve action founded on physiological and anatomical facts. As an example, the primitive conception of nerve action as a flowing of currents in and out of reservoirs can be adapted to this theory. And by doing so Dr. Münsterberg brings out the conceptions of the theory in a clear and tangible form.

According to this primitive conception of nerve action, "the outgoing current from the reservoir of the cortical cells, which flows towards the periphery through the axis cylinder, would come to a standstill if the lower level towards which it flows were full and had no outlet. But if the vent in the lower basin is open, so that the current can flow in the path to the muscle, then the stream can pour forth from the cortex. The opening of outgoing pipes in the lower center at once brings about a change in the upper reservoir. As long as the lower basin is blocked there can be no current in the upper basin, no matter how much fluid may pour into the upper reservoir from conducting paths. And if it is precisely upon the current that the turning of the psychical millwheel depends, then the mill stands still when the lower basin is stopped up, and begins to rattle away when the sluices are opened below. We must now ask for but one more step — that each lower reservoir stand in antagonistic union with a neighboring one, so that the opening of the sluices in one automatically closes those in the other."[1]

Besides mere vividness, an impression is characterized by many other qualities, such as being desirable or undesirable, familiar or unfamiliar, etc. Can the action-theory offer any explanation of these ? It seems to find no difficulty in the way. There is more than one path possible for the motor discharge. In fact, there are innumerable possibilities. Just what discharge shall correspond to any given stimulus, is dependent on a very complex set of conditions of which we know almost nothing. But variations in the path of discharge give rise to those different characteristics which give the idea a certain shade of value in consciousness (Wertnuance).

To sum up the theory in a few words: "Each element of consciousness is coördinated with a transfer from stimulation to discharge in the cortex, and in such a way that the quality of the sensation depends on the spatial position of the path of stimulation, the intensity of the sensation on the strength of the stimulus, the accompanying characteristics (Wertnuance) on the spatial position of the path of discharge, and the vividness of the sensation on the strength of the discharge."[2]

If the action-theory is to be of any service in psychology it must give us an explanation of psychological phenomena. And it seems to be applicable with special facility to the theory of attention. "That remains unnoticed," says Professor Münsterberg, "for which an action is not prepared, till the strength of the stimulus forces the act; but on the contrary the attention lays hold of that for which the motor discharge is prepared. * * * That which opposes and hinders attention according to the action-theory is always and only what leads to antagonistic actions. It is the reciprocal blocking of the canals of movement which prevents the dissipation of attention."[3] If attention passes over into apperception this means that the stimulus is able to start up a more complex reaction than that which corresponds to its own isolated activity. This is the foundation for the distinction between apperception and perception. If our mind fixes upon any object it means that a stimulus arouses a certain type of action.

---

[1] *Op. cit.*, p. 542–543.

[2] *Op. cit.*, pp. 548–549.

[3] *Op. cit.*, p. 550.

(*b*) *Criticism of the Theory.*

It seems probable that the experiments of this dissertation may throw some light on the theory of attention just outlined. In performing these experiments the idea to which the subject had to attend was to make the quickest possible movement on hearing a certain signal. If the signal comes when the subject is inattentive this must mean, according to Professor Münsterberg, that a certain path of movement which belongs to this idea is more or less blocked. What path of movement would this be? It seems that the motor path concerned in the movement of reaction — to which the idea corresponds — should be in great measure concerned. We should then expect in a series of reactions made under conditions favorable to attention that the maximum speed of movement would be greater than in a series where the attention is disturbed. For if the path of movement were more or less blocked, the full motor discharge could not pass along it, and the movement executed would necessarily be slower. Of course the movement of reaction is not the motor discharge which Professor Münsterberg speaks of as being the necessary condition for consciousness.[1] It comes as the result of far more complicated conditions than those which result in a motor discharge when an idea flashes into consciousness. But, notwithstanding this fact, the motor discharge passes along motor paths most likely to be followed by the discharges of those conscious processes concerned in reaction. If the idea of making a movement as quick as possible has any motor discharge, the path of discharge should be in great measure that concerned in making the movement. And if inattention blocks this path of movement we should certainly expect that the movement executed would be slower in consequence of the greater resistance to the motor discharge.

---

[1] Cf. *op. cit.*, p. 539.

In answer to this line of argument it might be said that the movement is executed only after the attention is focused, that the delay in reaction time means a reopening of the proper motor path, and that the movement then executed takes place as in a normal experiment. But such an answer seems to suppose the older theory of attention, which regards it as a kind of faculty, on which the motor processes may depend, rather than that attention depends on motor processes. When the inattentive subject hears the signal, there is a flash of consciousness — 'now's the time' — and the movement is executed. That flash of consciousness represents the focusing of the attention upon a rather complicated idea — to make the movement at once and as fast as possible. It was not the return of the more general idea to be ready to make the movement as fast as possible, as soon as the signal might be heard. It was a special determinate idea on which the movement followed as a matter of necessity. According to Professor Münsterberg, the flash of this idea into consciousness meant that a motor discharge had already taken place, that a certain type of action had been aroused. It passed along motor paths just as it happened to find them more or less blocked by previous conditions. Would not this discharge pass through the very subcortical centers and along the very paths concerned in the movement of reaction? And would not the movement of reaction be executed at the same time? And if this be true, any resistance encountered along this path (which, according to Professor Münsterberg, corresponds to a disturbance of the attention) will delay the reaction and lessen the speed of movement. But under conditions which were unfavorable to attention we found that the movement time was not lengthened, though the reaction time was considerably slower. Nor did the longer reactions correspond to the longer movements which occurred within the small limits of variation in the movement time.

It must be acknowledged, however, that the test we have applied cannot be considered as final. Perhaps the criticism must be considered as premature, for Professor Münsterberg has not yet made his theory sufficiently explicit. It still rests in the shades of metaphysics, for it has not yet ventured forth into the broad day of experimental science. If it should do so in the future it cannot yet be said in just what form it will appear.

But apart from this criticism suggested by the experiments, there are other points which, having once opened the subject, it may not be out of place to mention.

The first is a point of method. Dr. Münsterberg would place his theory far above all microscopical investigations. It is not for him to conform his theory to the facts of anatomy and physiology. Let the anatomists and physiologists be subject to the theory. Put forward a theory and let others look about for the facts to support it, seems to be the principle on which he has proceeded.[1]

Such a method refuses to take cognizance of the lesson taught by the history of modern science. Descartes' vortex theory to explain the motions of the planets was based on the metaphysical speculations; Newton's theory of gravitation was built upon calculations made from carefully observed facts. The former is now an historical curio, the latter still forms the basis of all astronomical calculation. This is but one instance of many which could be adduced as examples of the success of the inductive method of investigation, where speculation has failed. Can Professor Münsterberg boast of such special powers of penetration that he can afford to neglect the lesson taught by the discoveries of modern science? It must not be supposed, however, that I absolutely deny the value of metaphysical inquiry. It has its own field, and there purely inductive reasoning may be of little or no worth. But whenever facts are forthcoming, these must serve as the basis of speculation. And a theory which deals with subcortical motor centers, afferent and efferent paths, cortical and spinal cells, cannot plume itself upon being above the domain of facts, but must yield place to them and not go further than they allow.

The next point of criticism may seem to be one of mere words. But in speaking of the cortical motor discharge, Professor Münsterberg uses terminology which is more than technically at fault. It seems to be the expression of fanciful and improbable ideas. "Now physiology," he says, "gives us the further information that the cortex does not send its impulse directly to the peripheral muscles, but first acts upon subcortical centers, which in their turn send the impulse down to medullary ganglia."[1] What these subcortical centers are, or where they are situated he does not say. On the next page he seems to locate the medullary ganglia in the anterior horn of the spinal cord. From this it would seem that Professor Münsterberg divides the path for conduction of motor impulses into three stages, viz., (1) from the cortex to subcortical center; (2) from the subcortical center to the root-cells in the anterior horn of the spinal column; (3) from these root-cells to the muscle. He gives special prominence to the subcortical centers when a little later on he says that, 'the cerebral cortex, from which alone psychophysical stimuli flow forth, must work upon subcortical centers to discharge motor impulses.'[2] This statement, however, is untenable. According to all anatomists the fibres of the pyramidal tract pass directly from the Rolandic area down through the inner capsule to the crura and (omitting for the sake of simplicity the cranial nerves) thence through the medulla oblongata to the spinal cord, terminating in various places along its entire extent. Perhaps the term *center* could be applied to a nucleus. There are several nuclei and, if you will, centers in the afferent paths. But the pyramidal tracts, either direct or crossed, are nowhere interrupted by nuclei. Nowhere along either of these tracts is there a motor center on which the cortex must act in executing a movement. There is most probably another path which the cortex may employ in executing a movement, and this path does involve a subcortical motor center. It seems to be very well established that there is a much more complex motor path from the cortex to the pons, from the pons to the cerebellum and thence downward to the anterior roots *via* the antero-lateral descending tract.[3] But just what its function is cannot be said. But that the primary path of motor impulses is the pyramidal tract is the general position of anatomists and physiologists. And this path is certainly not interrupted by any subcortical motor centers.

---

[1] Cf. *op. cit.*, p. 406, p. 530, p. 540.

---

[1] *Op. cit.*, p. 532.

[2] *Op. cit.*, p. 533.

[3] Cf. Van Gehuchten, 'Anatomie du Système nerveux de l'Homme,' Vol. II., pp. 445–461.

Starting from the supposition that there are subcortical motor centers along the path of movement, Professor Münsterberg supposes two kinds whose action is reciprocal. One is bound to the other as to an antagonistic center, so that the stimulation of one subcortical center calls forth at the same time an inhibition of the antagonistic center. In support of this view he cites the experiments of Dr. Sherrington on the reciprocal action of antagonistic muscles. Dr. Sherrington has shown that for some muscles, and under certain conditions, a contraction of the extensors is accompanied by a relaxation of the flexors and *vice versa*. But Dr. Sherrington does not localize the centers for reciprocal action. He certainly does not postulate any subcortical center on which the cortex must act — thereby inhibiting one antagonistic center — and so executing the movement. Dr. Sherrington enumerated[1] the places of excitation where the phenomenon of innervation could be elicited. These were:

1. "The skin and skin nerves (with 'decerebrate rigidity');
2. The muscles and the afferent nerves of muscle (with 'decerebrate rigidity');
3. The dorsal (posterior) columns of the cord (with 'decerebrate rigidity');
4. Of the cerebellum (with 'decerebrate rigidity');
5. Of the crusta cerebri (with 'decerebrate rigidity');
6. Of the internal capsules;
7. Of the optic radiations;
8. Of the Rolandic cortex;
9. Of the occipital (visual) cortex."

But in all this there is no warrant for the conception of Dr. Münsterberg, that the cortex acts upon subcortical centers reciprocally connected, that one of these is inhibited and the antagonistic muscles relaxed, and the other discharges the root-cells of a set of muscles which contract. The fact that under certain conditions the phenomenon is called forth by excitation of the skin and skin nerves, afferent nerves of the muscles, and the dorsal columns of the cord, would indicate that 'reciprocal innervation' is of a reflex character, taking place perhaps at various places along the spinal cord or in the bulb and due to afferent impulses from the contracting muscles. Professor Münsterberg's postulation of reciprocal subcortical motor centers, which divide the pyramidal tract into two portions, is superfluous and contrary to the facts known to anatomical science.

---

[1] *Proc. of the Royal Society of London*, Vol. LXII., p. 187.

4. THE MOTOR CENTER EMPLOYED IN THE PROCESS OF REACTION.

Another point on which the results of these experiments bear is the question concerning the motor center employed in the process of reaction. This has been the result of no little theorizing. It originated before the distinction between sensory and muscular reactions was brought out. In an article published in *Philosophische Studien*[1] in 1886, Cattell put forward the view that with practised subjects a reaction was probably carried on without aid of the cortex. He wrote as follows: "In the same way a reaction such as we are considering can probably be made without need of the cortex, that is, without perception or willing. When a subject has had no practice in making reactions (in which case the reaction time is usually longer than 150 σ) I think the will-time precedes the occurrence of the stimulus. That is, the subject by a voluntary effort, the time taken up by which could be determined, puts the lines of communication between the center for simple sensations (in the *optic thalami* probably) and the center for the coördination of motions (in the *corpora striata*, perhaps, connected with the *cerebellum*), as well as the latter center, in a state of unstable equilibrium. When, therefore, a nervous impulse reaches the *thalami*, it causes brain changes in two directions; an impulse moves along the cortex, and calls forth there a perception corresponding to the stimulus, while at the same time an impulse follows a line of small resistance to the center for the coördination of motions, and the proper nervous impulse, already prepared and waiting for the signal, is sent from the center to the muscle of the hand. When the reaction has often been made, the entire cerebral process becomes automatic, the impulse of itself takes the well-traveled way to the motor center and releases the motor impulse."[2]

---

[1] Vol. III., p. 322. Cf. also *Mind*, 1886, Vol. XI., p. 232.

[2] *Mind*, *loc. cit.*

When Ludwig Lange, in 1888, published his article on the two kinds of reaction, he put forward the hypothesis that the motor center for muscular reaction is located in the cerebellum. It did not seem to him possible that there should be a special act of will involved in the actual process of muscular reaction, because the subject is not conscious of any new voluntary impulse in responding to the given stimulus. He looked upon the muscular reaction as a brain reflex which differs from the reflex actions of lower centers solely because it requires a preceding stimulus of the will to make the necessary preparation for executing the movement. This idea he made more explicit by further details. The will causes to be stored up in the subcortical center a certain amount of potential energy, which is held there in unstable equilibrium. A sensory stimulus coming into this center disturbs the equilibrium, and the energy thus set free flows over along motor paths to the muscle and is there manifested in the executed movement. This hypothesis can account for the previous tension of the muscles, the fact that muscular reactions are frequently made in response to the wrong stimulus, and certain other phenomena which accompany the shorter form of reaction.

But on what anatomical grounds can it be stated that the cerebellum is the subcortical center for muscular reaction? "As far as the cerebellum is concerned there is indeed established with anatomical certainty only —

(*a*) The immediate connection with the sensory fibres of the direct cerebellar tract; this would give sufficient room for conduction from the organs of touch;

(*b*) Connection with the motor regions of the cortex (Kleinhirnbrückenbahn), *i. e.*, with the center of voluntary muscular innervation;

(*c*) Connection with the sensory region of the cerebral cortex (Kleinhirn-Grosshirnbahn), *i. e.*, with the central sensory surfaces.

There can be added as very probable:

(*d*) A motor path to the spinal column. In this would be had the requisite connection with the group of reacting muscles.

In order to refer to the cerebellum muscular reactions for all the domains of sense, over and above these connections, there must be supposed:

(*e*) A sensory connection between the cerebellum and the optic nerve.

(*f*) A similar connection with the acoustic nerve.

Both these conducting paths are probably present, according to what is now supposed concerning the functions of the cerebellum."[1]

What Cattell thought was an analysis of the central processes of reaction in general, Lange claimed could be applied to the muscular form of reaction alone. He saw no reason to depart from Wundt's analysis of reaction when applied to the sensorial form.

Dr. Sigmund Exner, in his 'Psychische Erscheinungen,'[2] after referring to this view of Lange's, says: "There can be no doubt that this form of a subtle voluntary movement is to be referred to this, that the intention of the will to execute a special movement as quickly as possible in response to the given stimulus, rests upon a change which occurrences in the cortex call forth in the conditions of irritability in the subcortical centers. The condition thus brought about, which arises voluntarily, then occasions without a new conscious act that the entrance of a stimulus should produce a movement." Though Dr. Exner here commits himself to the position that the muscular form of reaction is carried on by a subcortical motor center, he does not specify any particular center.

In reference to Lange's position, Wundt writes: "Ludwig Lange has put forward the conjecture that the transmission of the sensory into a motor discharge within the cerebral cortex takes place only in the sensorial reaction; in the muscular reaction, however, it takes place in a lower center, probably in the cerebellum, or possibly in the ganglia of the midbrain. I do not believe that the arguments brought forward for this position are convincing, or that they even make the hypothesis advanced probable. Lange was certainly right if he held it was exceedingly probable that in muscular reaction the transfer takes place in a lower center, or that, at any rate, factors are wanting in it which in the sensorial reaction proceed from a higher center, standing in close relationship with the impulses of the will.

---

[1] *Philosophische Studien*, Vol. IV., pp. 517-518.

[2] P. 158.

But doubtless there are centers of different order in the cerebral cortex. If the muscular reaction takes place almost at the same time as the entrance of the sensation, then there is nothing in the way of supposing that the transfer takes place where the conscious sensation is discharged — in the primary sensory centers of the cerebral cortex. The delay present in sensorial reactions which prevents erroneous reactions, very early appeared to me to call for the hypothesis of an inhibitory action proceeding from an apperception center, which lasted until the stimulation (Signalreiz) belonging to this center caused a partial discharge of it. It also seems to me that the presence of transitional forms can best be harmonized with this view. For it is easy to understand that such an inhibition can be more or less active; but it is very difficult to see that between a reflex discharge, merely in a subcortical center, and a function of the cerebral cortex, such transitional values could be present."[1]

The evidence from our experiments seems to point to the conclusion that the centers for muscular reaction are not so widely separated as the cerebral cortex and the cerebellum. On the hypothesis that there is a distinction between sensorial and muscular reactions, it is quite clear that those made without a preparatory signal were sensorial reactions. For leaving the subject without a preparatory signal makes it impossible for him to attend primarily to the movement. He must be straining his attention to catch the sound of the reaction stimulus. On the other hand, the reactions made by the subjects when the preparatory signal was given were, as we have said, mainly of the muscular form. This was particularly true of Subject *B*. But we found no decided difference between the speeds of movement in the two cases. Perhaps the speed of movement in the reactions without preparatory signal was a little quicker than in the muscular reactions. But this was not constantly the case, and was probably due to the factors already mentioned.

Then, again, we compared the speed of the movement which came as the result of a voluntary choice with that which followed upon a reaction. In the experiments by which this comparison was made the subjects probably reacted in the muscular manner. But there was no decided difference in time between the voluntary movement and the movement of reaction.

---

[1] 'Grundzüge der physiologischen Psychologie,' 4th ed., II., p. 317. Cf. also 5th ed., III., p. 428.

It will be generally conceded that the motor center for the voluntary movement and the sensorial reaction is situated in the cortex. And at the same time Lange's conception of the process of muscular reaction cannot be shown to be impossible, even after the great advances made in the anatomy of the nervous system since 1888. But if we suppose that the center for muscular reaction is subcortical, it would seem likely that the line of movement executed by the center would differ from that of the movement executed by the cerebral cortex — and for two reasons. In the first place, if a subcortical center is reflexly discharged by the incoming stimulus in a muscular reaction, it is probable that the intensity of this discharge would be different from that of a discharge coming from the motor area of the cortex. The root-cells in the spinal cord would therefore be discharged with different force in each case and the subsequent movements would differ in speed. And in the second place, even though the normal maximum discharge of the cortical cells and the subcortical center might happen to be equal, it is still very unlikely that the discharges passing from the cortex and subcortical center would be so equally distributed that the final resultant which reached the root-cells of the spinal cord would be the same in the two cases. The path from the cerebral cortex to the spinal root-cells is without interruption along the fibers of the pyramidal tracts. If, for instance, the subcortical center were the cerebellum, the sensory stimulus would reach it through different nuclei along a different path, and then when the motor cells of the cerebellum were discharged the impulse would not pass to the root-cells by the pyramidal tract, but probably by the antero-lateral descending tracts. Different connections would have to be made in the grey matter of the spinal cord from those used by the pyramidal tract. Such a difference in the path of movement would probably result in a very different distribution of the motor discharges, which would be manifested in the record of the movement time. Not finding evidence of such a difference, we conclude that the center for the different kinds of movement cannot be so widely separated as the cortex and a subcortical center. It seems most reasonable to suppose that the motor cells concerned are those of the Rolandic area.

5. THE DISTINCTION BETWEEN MUSCULAR AND SENSORIAL REACTIONS.

Now something must be said of the validity of the distinction between muscular and sensorial reactions. On this point there are two very opposite opinions. That of the Wundtian school may be expressed in Wundt's own words: "Um möglichst vollständige Reactionszeiten zu erhalten, muss die Aufmerksamkeit intensiv auf den erwarteten Sinneseindruck gerichtet werden, wobei sich die Spannung der Aufmerksamkeit immer zugleich durch Muskelempfindungen des betreffenden Sinnesgebiets, z. B., in den Accommodations -und Augenmuskeln dem Tensor-tympani verräth; dagegen darf sich die Aufmerksamkeit nicht aus das reagirende Bewegungsorgan richten, und das zuverlässige Kriterium für die Erfüllung dieser Bedingung liegt darin, dass die Muskelspannungen dieses Organs unmerklich sind. Will man dagegen einen extrem verkürzten Reactionsvorgang erhalten, so ist es nöthig die Aufmerksamkeit ausschliesslich auf das reagirende Organ zu verrichten, was immer mit einer intensiveren Muskelspannung desselben verbunden ist."[1]

The ground for the distinction, according to Wundt and his school, is the manner of directing the attention. All subjects who can at will place the strain of attention in the afferent or efferent circuit will be able to react either sensorially or muscularly.

Professor Baldwin, however, in propounding the type-theory of simple reaction sought another ground for the distinction. According to him, the root of the distinction lies in individual differences of the subjects. "We find," he says, "cases of relatively shorter sensory times similar to mine reported (for electrical stimulus) by Cattell, and (for sound stimulus) by Flournoy. We may accordingly say that such individual differences are clearly established, and must hereafter be acknowledged and accounted for in any adequate theory of reaction. The attempt of Wundt, Külpe, and others to rule these results out, on the ground of incompetency of the reagents, is in my opinion a flagrant *argumentum in circulo*. Their contention is that a certain mental *Anlage* or aptitude is necessary in order to experimentation on reaction times. And when we ask what the *Anlage* is, we are told that the only indication of it is the ability of the reagent to turn out reactions which give the distinction between motor and sensory time which Wundt and his followers consider the proper one. In other words, only certain cases prove their result, and these cases are selected because they prove that result. It is easy to see that this manner of procedure is subversive both of scientific method and of safely acquired results in individual psychology. For the question comes: What of these very differences of individual *Anlage?* How did they arise; what do they mean? Why do they give different reaction time results? To neglect these questions and rule out all *Anlagen* but one, is to get the psychology of some individuals and force it upon others and thus to make the reaction method of investigation simply the handmaid to dogma."[1]

---

[1] 'Grundzüge der physiologischen Psychologie,' II., p. 309 (4th ed.). Cf. also a somewhat different expression of the distinction in the 5th ed., III., p. 412 ff.

"The individual differences in reaction arise from the fact that there is a natural and permanent tendency in all people to take the same cue for their movements that they do in speech. The doctrine of 'types' rests upon certain facts which may be briefly summed up. A voluntary motor performance — say speech — depends in each particular exercise of it upon the possibility of getting clearly in mind (*interieur*, *innerlich*) some mental picture, image, presentation, which has come to stand for or represent the particular movements involved. This mental 'cue' or representation may belong to either of two great classes: it may be a 'sensory' cue or a 'motor' cue. People are of the sensory type, or of the motor type for speech, according as their cue in speech is sensory or motor, that is, according as in speaking they think of the sounds of the words as heard, the looks of the words as written, etc. — the cues furnished by the special senses associated habitually with speech — this on the one hand; or according as, on the other hand, they think of or have in mind the movements of the vocal organs, lips, tongue, etc., involved in speech."[1] "So in simple hand movements people may show the sensory and motor types. This is my hypothesis. The man, therefore, who gives relatively shorter motor reactions is a 'motor' in his type; with him the thought of movement is the most facile beginning of the movement, just because it is really the movement and nothing else that he thinks of. That is his *Anlage*. But the man who gives relatively shorter sensory (auditory, visual) reactions is a 'sensory' in his type; with him the attempt to think of the movement *as a movement* interferes with the prompt and exact execution of it, just because he is not accustomed to execute his movements in that way. That is his *Anlage*."[2]

---

[1] 'Types of Reaction,' J. Mark Baldwin (and W. J. Shaw), PSYCHOLOGICAL REVIEW, 1895, II., p. 265.

It would be out of place in our present paper to criticise extensively either of these theories of reaction, since we have made no special test concerning them. But it does seem incumbent upon us to state what was meant in the course of the paper when the terms sensory and muscular reaction were used.

We have supposed with Wundt and his school that when the strain of attention (Spannung) is really in the efferent circuit all subjects will react more quickly than when the strain of attention is in the afferent circuit. But the attention here required is of the nature of tension, or what the Germans call *Spannung*. Only secondarily is it a visualization of the movement or of the signal. However, Professor Baldwin's experiments do present a real difficulty to this position, and it would not be fair to ignore them or arbitrarily rule them out of court. They are facts, and as such they must be accounted for. But their ultimate explanation may not be in the theory of types as expounded by Professor Baldwin. Some subjects find it hard to direct their attention to the movement, and others find difficulty in directing their attention to the signal. Perhaps the reason for this is to be sought in the fact that some are in the habit of attending to sensory images and others to motor images. But when a subject who is really of the motor type tries to react sensorially and gives a short reaction, he may indeed picture to himself a sound or a light, but it might be said that the attention or *Spannung* was not primarily in the afferent, but as a matter of fact in the efferent circuit. But at the same time, if he commenced to think about the movement, to try to see it or feel it, what was before carried on automatically might be interfered with by being consciously attended to. Tension would be drawn away from the muscles, to be given to visualizing the movement. In every reaction there are two mental images which fluctuate more or less in consciousness while the subject is waiting to react. One is the sensory representation of the signal; the other is the motor (or perhaps visual) representation of the movement. But while this fluctuation of mental images is going on there is not a simultaneous changing of the center of neural tension. Too little attention has been given to this distinction — between Spannung and Aufmerksamkeit — in previous discussions of the problem. Perhaps a better understanding of the distinction might show that the two theories are really closer together than they seem to be at present.

---

[1] *Loc. cit.*, p. 268.

[2] *Loc. cit.*, pp. 269–270.

BIBLIOGRAPHY.

General Works.

Lewellys F. Barker, The Nervous System and Its Constituent Neurones, New York, 1899.

Sigmund Exner, Entwurf zu einer physiologischen Erklärung der psychischen Erscheinungen, Leipzig, 1894.

M. Foster, A Text Book of Physiology, Part II., The Central Nervous System, New York, 1890.

Warren P. Lombard, General Physiology of Muscle and Nerve, An American Text Book of Physiology, pp. 32–151, Philadelphia, 1896.

Hugo Münsterberg, Grundzüge der Psychologie, Leipzig, 1900.

A. Van Gehuchten, Anatomie du Système Nerveux de l'Homme, two volumes, Louvain, 1900.

Wilhelm Wundt, Mechanik der Nerven und Nervencentren, Erste Abtheilung, Erlangen, 1871, Zweite Abtheilung, Stuttgart, 1876.

Physiology of Processes Concerned in a Voluntary Movement.

H. Charlton Bastian, On the Neural Processes underlying Attention and Volition, *Brain*, Vol. XV., 1892, pp. 1–34.

—— Note on the Relation of Sensory Impressions and Sensory Centers to Voluntary Movements, *Proc. of the Roy. Soc. of London*, Vol. LVIII., pp. 89–98.

H. Beaunis, Contraction simultanée des muscles antagonistes, *Archives de physiologie normale et pathologique*, 1889, pp. 55–67.

Chas. E. Beevor, On Some Points in the Actions of Muscles, *Brain*, XIV., 1891, pp. 51–62.

A. Chauveau, On the Sensori-motor Nerve Circuit of Muscles, *Brain*, XIV., 1891, pp. 145–178.

G. Demeny, Du rôle mécanique des muscles antagonistes, *Archives de physiologie normal et pathologique*, 1888, pp. 55–69.

R. du Bois-Reymond, Spezielle Muskelphysiologie, Berlin, 1903.[1]

Th. W. Engelmann, Ueber den Ursprung der Muskelkraft, 2d ed., Leipzig, 1893.

---

[1] This work contains a copious bibliography of the mechanism of muscular contraction.

—— On the Nature of Muscular Contraction, *Proc. of the Roy. Soc. London*, LVII., pp. 411–433.

Johannes Frentzel, Ein Beitrag zur Frage der Quelle der Muskelkraft, *Archiv für die ges. Physiologie*, Vol. LXVIII., pp., 212–221.

J. Berry Haycraft, Voluntary and Reflex Muscular Contractions, *Journal of Physiology*, 1890, Vol. XI., pp. 352–367.[1]

E. Hitzig, Hughlings Jackson and the Cortical Motor Centers, *Brain*, 1900, XXIII., pp. 545–581.

F. W. Mott and C. S. Sherrington, Experiments on the Influence of Sensory Nerves upon the Movement and Nutrition of the Limbs, *Proc. of Roy. Soc. London*, LVII., 481–488.

C. S. Sherrington, Note on the Knee-Jerk and the Correlation of Action of Antagonistic Muscles, *Proc. of the Roy. Soc. London*, LII., pp. 556–564.

—— Further Experimental Note on the Correlation of Action of Antagonistic Muscles, *Proc. of the Roy. Soc. London*, LIII., pp. 402–420.

—— On Reciprocal Innervation of Antagonistic Muscles, Third Note, *Proc. of the Roy. Soc. London*, LX., pp. 414–416.

—— Antagonistic Muscles and Reciprocal Innervation, Fourth Note, *Proc. of the Roy. Soc. London*, LXII., pp. 183–187.

—— On the Reciprocal Innervation of Antagonistic Muscles, Fifth Note, *Proc. of the Roy. Soc. London*, LXIV., pp. 179–181.

—— On the Innervation of Antagonistic Muscles, Sixth Note, *Proc. of the Roy. Soc. London*, LXVI., p. 66.

J. Sully, The Psycho-physical Process in Attention, *Brain*, XIII., 1890, pp. 145–164.

Augustus D. Waller, The Sense of Effort: An Objective Study, *Brain*, XIV., 1891, pp. 179–249.

—— On the Functional Attitude of the Cerebral Cortex, *Brain*, XV., 1892, pp. 329–396.

LITERATURE ON REACTION TIME.

For accounts of the literature on Reaction Time, cf. the following:

Nicolaus Alechsieff, Reactionszeiten bei Durchgangsbeobachtungen, *Philosophische Studien*, XVI., p. 1.

---

[1] References will be found in this article to previous literature on [illegible] nature of muscular contraction.

E. Kraepelin, Ueber die Beeinflussung einfacher psychischer Vorgänge, Jena, 1892.

E. B. Titchener, Simple Reactions, *Mind*, N. S., 1895, IV., pp. 74–81.

Wilhelm Wundt, Grundzüge der physiologischen Psychologie, 5th ed., 1903, Vol. III., Ch. XVIII., pp. 377–476.

Besides these, there may be mentioned the following papers made use of in the preparation of this dissertation.

J. M. Baldwin (and W. J. Shaw), Types of Reaction, *Psychological Review*, 1895, II., pp. 259–273.

C. B. Bliss, Investigations in Reaction Time and Attention, *Studies from Yale Psy. Lab.*, I., 1892–3, pp. 1–55.

J. McKeen Cattell, On Reaction Times and the Velocity of the Nervous Impulse, *Nat. Acad. of Sci.*, VII., pp. 393–415.

J. M. Baldwin, The 'Type-Theory' of Reaction, *Mind*, N. S., 1896, V., pp. 81–90.

W. G. Smith, Antagonistic Reactions, *Mind*, Jan., 1903, pp. 47–58.

E. B. Titchener, The 'Type-Theory' of Simple Reactions, *Mind*, N. S., IV., 1895, pp. 506–514; and V., 1896, pp. 236–241.

The Force and Rapidity of Movements.

Dobri Awramoff, Arbeit und Rhythmus, *Philosophische Studien*, XVIII., pp. 515–562.

E. B. Delabarre, R. R. Logan and A. Z. Reid, The Force and Rapidity of Voluntary Movements, *Psychol. Review*, IV., 1897, p. 615.

A. Cleghorn, The Inhibition Time of a Voluntary Muscular Contraction, *Amer. Jour. of Physiology*, 1901, V., 281–286.

Charles Féré, L'énergie et la vitesse de mouvements volontaires, *Revue philosophique*, XXVIII., 1889, pp. 36–69.

—— Note sur l'énergie et la vitesse des divers mouvements des membres, *Comptes rendus de la Soc. de Biol.*, 10^e S., III., 1896, pp. 313–314.

—— Le travail et le temps de réaction, *Comptes rendus de la Soc. de Biol.*, 9^e S., IV., 1892, pp. 432–435.

J. B. Haycraft, Upon the Production of Rapid Voluntary Movements, *Journal of Physiology*, XXIII., pp. 1–9.

Wm. R. Jack, On the Analysis of Voluntary Movements by Certain [illegible] Instruments, *Proc. of the Roy. Soc. London*, LVII., pp. 4[illegible]-481; also in *Journal of Anat. and Phy.*, XXIX., 473–478.

J. Orschansky, Zur Lehre von der Willensthätigkeit, *Archiv für Physiologie*, 1889, pp. 173–198.

E. W. Scripture and Jno. M. Moore, A New Reaction-Key and the Time of Voluntary Movement, *Studies of Yale Psy. Lab.*, I., 1892–3, pp. 88–91.

REINFORCEMENT AND INHIBITION OF MOVEMENT.

Dr. De Boeck et Is. Gunzburg, De l'influence de l'alcool sur le travail du muscle fatigué, *Bull. de la Société de Médecine mentale de Belgique*, 1899, pp. 306–323.

N. Bubnoff und R. Heidenhain, Ueber Erregungs- und Hemmungs-Vorgänge innerhalb der motorischen Hirncentren, *Archiv für d. ges. Physiologie*, XXVI., pp. 137–200.

J. Clavière, Le travail intellectuel dans ses rapports avec la force musculaire measurée au dynamomètre, *L'Année Psy.*, 1900 (1901), VII., pp. 206–230.

A. Cleghorn, The Reinforcement of Voluntary Muscular Contractions, *Am. Journal of Physiology*, 1898, I., pp. 336–345.

C. Collucci, L'Ergografo nelle ricerche di psico-fisiologia, *Annali di Nevrologia*, 1899, XVII., 205–294.

S. Exner, Zur Kenntniss von der Wechselwirkung der Erregungen im Centralnervensystem, *Archiv für die ges. Physiologie*, XXVIII., pp. 487–506.

Charles Féré, Etudes expérimentales de l'influence des excitations agréable et des excitations désagréable sur le travail, *L'Année Psy.*, 1900 (1901), VII., pp. 82–129.

—— Etudes expérimentales sur le travail chez l'homme et sur quelques conditions qui influent sur sa valeur, *Journal de l'Anat. et de la Physiologie*, 1901, XXXVII., 1–79.

—— L'excitabilité comparée des deux hemisphères cérébraux chez l'homme, *L'Année Psy.*, 1900 (1901), VII., pp. 30–142.

—— L'influence de l'alcool et du tabac sur le travail, *Archives de Neurologie*, 1901, XII., 369–384, 463–475.

—— L'influence du bouillon sur le travail, *Comptes rendus Soc. de Biologie*, 1900, p. 829.

—— De l'influence de l'échauffement artificiel de la tête sur le travail, *Journal de l'Anatomie et de la Physiologie*, 1900, XXXVII., pp. 291-308.

—— L'Influence de quelques excitations déplaisantes sur le travail, *Comptes rendus Soc. de Biologie*, 1900, p. 1083.

—— Note sur l'action excitante de l'antipyrine, *Journal de Neurologie*, 1901, VI., pp. 631–634.

—— Note sur l'influence réciproque du travail physique et du travail intellectuel, *Journal de l'Anat. et de la Physiologie*, 1901, XXXVII, pp. 625–637.

—— Notes sur la rapidité des effets des excitations sensorielles sur le travail, *Comptes rendus Soc. de Biologie*, 1900, p. 845.

—— L'influence sur le travail d'un muscle de l'activité d'autres muscles, *Nouv. Icon. Salpêtrière*, 1901, XIV., pp. 432–461.

—— La pathologie des émotions, Ch. III., Paris, 1892.

—— Recherches expérimentales sur la fatigue par des excitations de l'odorat, *Nouv. Icon. Salpêtrière*, 1901, XIV., pp. 327–353.

—— Sensation et Mouvement, 1st ed., Paris, 1887; 2d ed., 1901.

—— Travail alternatif des deux mains, *L'Année psychol.*, 1900 (1901), VII., pp. 130–142.

—— Les variations de l'excitabilité dans la fatigue, *L'Année psychol.*, 1900 (1901), VII., pp. 69–81.

Aug. Forel, Lähmt der Alkohol die Muskelleistung oder fordert er sie? *Correspondenz-Blatt für Schweizer Aerzte*, 1897, XXVII., p. 672.

Hermann Frey, Ueber den Einfluss des Alkohols auf die Muskelermüdung, *Mitth. aus klin. und med. Instituten der Schweiz*, 1896, IV., H. i., pp. 1–47.

A. Freusberg, Ueber Erregung und Hemmung der Thätigkeit der nervösen Centralorgane, *Archiv für die ges. Physiologie*, X., pp. 174–208.

J. G. Gonzalez, The Study of Inhibition, *N. Y. Med. J.*, 1901, LXXI, pp. 116–117.

Vaughan Harley, Sugar as a Food in the Production of Muscular Work, *Proc. of the Roy. Soc. Lond.*, 1903, LIV., p. 480.

—— The Value of Sugar and the Effect of Smoking on Muscular Work, *Journal of Physiology*, 1894, XVI., p. 97.

R. Heidenhain, Ueber Erregung und Hemmung, *Arch. für die ges. Physiologie*, XXVI., pp. 546–557.

H. E. Hering und C. S. Sherrington, Ueber Hemmung der Contraction willkürlicher Muskeln bei elektrischer Reizung der Grosshirnrinde, *Archiv für die ges. Physiologie*, LXVIII., pp. 222–228.

LUDWIG HOFBAUER, Interferenz zwischen verschiedenen Impulsen im Centralnervensystem, *Archiv für die ges. Physiologie*, LXVIII., pp. 546–595.

KRONECKER ET CUTTER, Effets du travail de certains groupes musculaires sur d'autres groupes qui ne font aucun travail, *Comptes rendus, Acad. de Méd.*, 1900, CXXXI., p. 492.

WARREN P. LOMBARD, Some Influences which Affect the Power of Voluntary Muscular Contraction, *Journal of Physiology*, 1892, XIII., p. 44.

ARNALDO MAGGIORA, De l'action physiologique du massage sur les muscles de l'homme, *Arch. Ital. de Biologie*, 1891, XVI, p. 225.

UGOLINO MOSSO, Action physiologique de la cocaine, etc., *Arch. Ital. de Biologie*, 1891, XIV., p. 247.

M. STERNBERG, Die Sehnenreflexe und ihre Bedeutung für die Pathologie des Nervensystems,[1] Wien, 1893.

MAX VERWORN, Zur Physiologie der nervösen Hemmungserscheinungen, *Archiv für Physiologie*, 1900 (Suppl. Bd.), pp. 105–123.

GUY M. WHIPPLE, The Influence of Forced Respiration on Psychical and Physical Activity, *Am. Journal of Psychology*, 1897–8, IX., pp. 560–571.

M. BROWN-SÉQUARD, Champ de l'action de l'inhibition, *Archives de Physiologie normal et pathologique*, 1888, pp. 1–23.

AUGUSTUS D. WALLER, On the Inhibition of Voluntary and Electrically Executed Muscular Contraction by Peripheral Excitation, *Brain*, XV., 1892, pp. 35–64.

[1] The literature which bears on the stimuli which affect the knee-jerk should be considered here. Most of it will be found in the bibliography appended to Dr. Sternberg's monograph, which contains over eight hundred references.

The Psychological Review

EDITED BY
J. MARK BALDWIN AND HOWARD C. WARREN
JOHNS HOPKINS UNIVERSITY PRINCETON UNIVERSITY

WITH THE CO-OPERATION OF

A. C. ARMSTRONG, WESLEYAN UNIVERSITY, MIDDLETOWN, CONN.; ALFRED BINET, ECOLE DES HAUTES-ÉTUDES, PARIS; W. L. BRYAN, INDIANA UNIVERSITY, BLOOMINGTON, IND.; WILLIAM CALDWELL, MCGILL UNIVERSITY; MARY W. CALKINS, WELLESLEY COLLEGE, WELLESLEY, MASS.; JOHN DEWEY, J. R. ANGELL, UNIVERSITY OF CHICAGO; C. LADD FRANKLIN, BALTIMORE; H. N. GARDINER, SMITH COLLEGE, NORTHAMPTON, MASS.; G. H. HOWISON, UNIVERSITY OF CALIFORNIA; P. JANET, COLLÈGE DE FRANCE; JOSEPH J. JASTROW, UNIVERSITY OF WISCONSIN; ADOLF MEYER, N. Y. PATHOL. INSTITUTE, WARD'S ISLAND, N. Y.; C. LLOYD MORGAN, UNIVERSITY COLLEGE, BRISTOL; HUGO MÜNSTERBERG, HARVARD UNIVERSITY; E. A. PACE, CATHOLIC UNIVERSITY, WASHINGTON; G. T. W. PATRICK, UNIVERSITY OF IOWA, IOWA CITY, IOWA; CARL STUMPF, UNIVERSITY, BERLIN; R. M. WENLEY, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICH.

THE PSYCHOLOGICAL REVIEW, New Series, is issued in two sections; the Article Section, containing original contributions, appears bimonthly, on the first of January, March, May, July, September, and November, the six numbers comprising a volume of at least 400 pages; the Literary Section (*Psychological Bulletin*) containing critical reviews, notices of books and articles, psychological news and notes, university notices, announcements, and shorter discussions, appears on the fifteenth of each month, and forms a separate volume of at least 300 pages.

Annual Subscription to Both Sections, $4.00 (Postal Union, $4.30); Bulletin alone, $2.00 (Postal Union, $2.20); Single Numbers of Article Section, 50c. (53c.); of Bulletin, 25c. (27c.).

In connection with THE REVIEW there is published annually

THE PSYCHOLOGICAL INDEX

a bibliography of books, monographs, and articles upon psychological and cognate topics that have appeared during the year. The *Index* is issued in March, and may be subscribed for in connection with THE REVIEW, or purchased separately. (*Index* and REVIEW, $4.50 per annum; Postal Union, $4.85. *Index* alone, 75 cents; Postal Union, 80 cents.)

In connection with THE REVIEW there is also published a series of

MONOGRAPH SUPPLEMENTS

consisting of longer researches or treatises which it is important to publish promptly and as units. The *Monographs* appear at irregular intervals and are gathered into volumes of about 500 pages, with a uniform subscription of $4.00 (Postal Union, $4.30). The price of single numbers varies according to the size. Five volumes have already been issued.

Subscriptions, orders, and business communications may be sent direct to Professor H. C. WARREN, Businesss Manager, Princeton, New Jersey, U. S. A., or forwarded through the publishers or agent.

PUBLISHED BY
THE MACMILLAN COMPANY,
41 N. QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK

AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St., W. C.);
LEIPZIG (Hospital St., 10); PARIS (76 rue de Rennes).

The Psychological Review,

MONOGRAPH SERIES.

The following *Monographs* have already appeared:

Vol. I.

1. *On Sensations from Pressure and Impact: Harold Griffing. Pp. 88. 75 cents
2. Association: Mary Whiton Calkins. Pp. vii+56. 50 cents.
3. *Mental Development of a Child: Kathleen Moore. Pp. iv+150. $1.25.
4. A Study of Kant's Psychology: Edward Franklin Buchner. Pp. viii+208. $1.50

Vol. II.

5. Problems in the Psychology of Reading: J. O. Quantz. Pp. iv+51. 50 cents.
6. The Fluctuation of Attention: John Perham Hylan. Pp. ii+78. 75 cents.
7. *Mental Imagery: Wilfrid Lay. Pp. ii+59. 50 cents.
8. Animal Intelligence: Edward L. Thorndike. Pp. ii+109. $1.00.
9. The Emotion of Joy: George Van Ness Dearborn. Pp. ii+70. 75 cents.
10. Conduct and the Weather: Edwin G. Dexter. Pp. viii+105. $1.00.

Vol. III.

11. On Inhibition: B. B. Breese. Pp. iv+65. 75 cents.
12. On After-images: Shepherd Ivory Franz. Pp. iv+61. 75 cents.
13. *The Accuracy of Voluntary Movement: R. S. Woodworth. Pp. vi+114. $1.00.
14. A Study of Lapses: H. Heath Bawden. Pp. iv+122. $1.00.
15. The Mental Life of the Monkeys: E. L. Thorndike. Pp. iv+57. 50 cents.
16. The Correlation of Mental and Physical Tests: C. Wissler. Pp. iv+62. 50 cents.

Vol. IV.

17. Harvard Psychological Studies, Vol. I.; containing sixteen experimental investigations from the Harvard Psychological Laboratory: Edited by Hugo Münsterberg. Pp. viii + 654. $4.00.

Vol. V.

18. Sociality and Sympathy: J. W. L. Jones. Pp. iv+91. 75 cents.
19. The Practice Curve: J. H. Bair. Pp. 70. 75 cents.
20. The Psychology of Expectation: Clara M. Hitchcock. Pp. iv + 78. 75 cents.
21. Motor, Visual and Applied Rhythms: J. B. Miner. Pp. iv + 106. $1.00.
22. The Perception of Number: J. F. Messenger. Pp. iv + 44. 50 cents.
23. A Study of Memory for Connected Trains of Thought: E. N. Henderson. Pp. iv + 94. 75 cents.

Vol. VI. (To contain about 500 pages.)

24. A Study in Reaction Time and Movement: T. [illegible]ore. Pp. iv+86. 75 cents.

* Monographs so marked are not sold separately.

Vol. VI
No. 2

Monograph Supplements

May, 1904
Whole No. 25

THE

Psychological Review

EDITED BY

J. MARK BALDWIN
JOHNS HOPKINS UNIVERSITY

HOWARD C. WARREN
PRINCETON UNIVERSITY

AND

CHARLES H. JUDD
YALE UNIVERSITY
(*Editor of the Monograph Series*)

The Individual and his Relation to Society

As Reflected in the British Ethics of the Eighteenth Century

BY

JAMES HAYDEN TUFTS

[Vol. I., No. 6, of University of Chicago Contributions to Philosophy]

THE MACMILLAN COMPANY,
41 NORTH QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK
AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St., W. C.);
LEIPZIG (Hospital St., 10); PARIS (76 rue de Rennes).

COPYRIGHT, 1904
BY JAMES HAYDEN TUFTS

PRESS OF
THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

CONTENTS.

PAGE.
I. General Characteristics of the Life and Thought of the Century 1
II. The New Ethical Problem, and the Early Appearance of the Concept of a Moral Sense 5
III. The Individual Constituted by Instincts and Feeling — Shaftesbury 7
  1. Primacy of Feeling 7
  2. Subjectivity of Goodness and Virtue 8
  3. The Individual Naturally Social 9
  4. Egoistic and Social in Motivation 11
  5. The Moral Sense as a Trans-subjective Faculty 13
IV. The Individual as the Outcome of Egoism Directed by Pressure of Social Forces — Mandeville 13
  1. Conflicting Ideals in the Modern Individual 14
  2. The Moral Resolved into the Merely Social 15
  3. The Elements in Man's Alleged Sociableness 16
  4. The Moral Generated from the Economic 17
V. The Individual Enlarged by New Capacities for Pleasure — Hutcheson 18
  1. The Moral Sense as a New Avenue of Pleasure 18
  2. The Deeper Moral and Social Implication of Honor..... 20
  3. The Individual's Capacity for Disinterested Benevolence. 21
VI. The Particular Impulses and Feelings Related to the Self — Butler, John Clarke 22
  1. The Economic Category of Interest Distinguished from the Moral and Social 23
  2. Reason as a Unifying Principle 26
  3. The Individual as Source of Moral Authority 27
  4. The Self-satisfaction Necessary for Moral Action 29
VII. The Moral and Social Individual Explained by Association and Imitation — Gay, Hartley 31
  1. The Self of the Purely Analytic Method 31
  2. Association as a Synthetic Principle 32

VIII. The Moral and Social Individual Explained by Sympathy — Hume 34
  1. The Two-fold Hume, Method versus Material 34
  2. Conflict in the Account of Good and Virtue 35
  3. Conflict in the Account of Sympathy 37
  4. Conflict in the Account of Justice 41
  5. Conflict in the Account of Benevolence 45

IX. The Individual the Creation of Social Forces — Adam Smith 47
  1. The Social Factor in Moral Judgments 48
  2. The Rational Element in the Moral Individual 50
  3. The Inadequacy of Sympathy as Socializing Agency ... 52
  4. How Can the Individual Become an Impartial Spectator? 54
  5. Smith the Interpreter of his Age 57

Conclusion 58

SECTION I.

GENERAL CHARACTERISTICS OF THE LIFE AND THOUGHT OF THE CENTURY.

The great determining forces of the eighteenth century were industrial and intellectual, as those of the two preceding centuries had been religious and political. Puritanism set for the chief end of man 'to glorify God and enjoy him forever,' but the average Englishman was coming to be more and more interested in his business pursuits. Instead of daring the seas, clearing forests, suffering or inflicting persecutions for the glory of God, he was disposed rather to found colonies for purposes of trade, and to tolerate heretics if they were good neighbors and customers. Strenuous liberty was the motto of Milton. 'O, happiness, our being's end and aim' was the voice of the age of Pope; and though no doubt liberty was one of the factors that made up happiness, it was not foremost or chief. Comfort, wealth, intelligence bulked much more largely in its constitution. Not church and state but private and business relations were the centers of interest. Thought sought the criteria and motives of these in terms of the individual himself, and was scarcely conscious of any universal at all. We hear much of affections, of opinions of others, and of the usefulness of acts — little of law and duty.

The more precise nature of these industrial forces has been previously characterized,[1] but while they had been steadily at work during the preceding period, they had manifested themselves largely in relation to religion and politics, and were held in subjection to those more imperious interests. Now they came to expression in social and moral relations.

In the first place, they began to break down classes and introduce a new ground for social recognition. For although trade was not yet so conspicuously the field for the display of genius that the rich merchant, as such, was recognized as the social equal of the landed gentry, yet the successful traders could buy land, and 'in the next generation make gentlemen,' as Defoe quaintly remarks. The bars of caste, which even the doctrine of religious equality could not break, were lowered, even if not thrown down, for the recognition of the new order.

---

[1] *University of Chicago Contributions to Philosophy*, No. 5.

New agencies had to be introduced to accomplish the results formerly achieved by religious and political authority. 'Subordination is sadly broken down in this age,' mourned Dr. Johnson, himself the protagonist of literary independence; 'No man now has the same authority his father had, except the gaoler.' And what were the new agencies? The egoistic sanctions of self-interest and the commercial motives of value to be received. The great statesman of the first half of the century was accustomed to ask young men entering parliament whether they were going to be saints or Romans, and though the maxim attributed to him, that 'every man has his price, may have referred on his lips to a group of associates, he apparently considered it a good working hypothesis for the politician. The instructive thing about his practice, however, was that it was simply the practical exemplification of that separation between the value of the act and the motive of the agent which has found expression in certain types of ethical theory. Walpole did not bribe men to do acts which were injurious to the public weal. He bribed them, as he said, to be honest. He was merely using much gentler and more agreeable means to secure what the religious and political zealots of the preceding age had attempted by force. He was recognizing the agent's personal liberty which had been achieved, but was estimating the agent's self in terms of commercial interests alone. Not until Pitt sounded again the note of patriotism did English politics appeal to the larger Individual, the patriotic self which had almost forgotten its own existence. For though the complaint of John Brown[1] may have been exaggerated by personal temperament, there is little question of the absorption of the time in private affairs.

---

[1] 'Love of our country is no longer felt, and except in a few minds of uncommon greatness, is extinct,' cited, Lecky, *England in the Eighteenth Century*, I., 509.

Similar characteristics appear in the religious life and doctrine which may be considered together. 'Religion in England does no harm,' wrote Montesquieu, and the reasons were not far to seek. Unless under stress of extreme enthusiasm, even the most orthodox citizen is loath to interfere with the beliefs of his business associates. He is even inclined to make exceptions in favor of his neighbors to the universal applications of his dogmas. But the average Englishman of this age was not even orthodox in any vital and influential fashion. The articles and the confession might receive intellectual assent, but they no longer had significance for the age. The preachers but voiced the interests of their audiences when they forgot to preach total depravity and emphasized the moral sense, when they ignored predestination and regeneration, and dwelt rather on divine and human goodness. Omitting wholly the emotional element as 'enthusiasm,'[1] too tolerant or indifferent to grapple vigorously with the grander metaphysical problems which had laid hold upon the whole being of a Calvin or a Milton, they sought rather to prove Christianity 'reasonable' and to emphasize its value both for the life that now is and for that which is to come. In a word, instead of being the prophets, commissioned with authority to reprove, they were the teachers of an ethical system which they sought to commend as rational and profitable. But however valuable the virtues taught, there was little appeal to motives which rouse aspiration or enlarge the self. The values of things unseen and eternal were measured in terms of experienced pleasure rather than in terms of an enlarging life. The suggestions of possibilities yet uncomprehended, of attainment not yet achieved, which had inspired the lofty ideals and ardent endeavor of believers in supernatural religion, fell away from a religion which was as powerless and limited as it was natural and reasonable. Hence, the successive titles, 'The Reasonableness of Christianity,' 'Christianity not Mysterious,' 'Christianity as Old as Creation,' showed a tendency to remove from Christianity any elements not clearly intelligible and reduce it to a system of morality, while the replies of the opponents of deism assumed the same premises as to the nature of religion. Butler, who was serious enough to see in 'nature' the same mysteries which the deists had eliminated so glibly from religion, did much to deepen the conception of the problem, though setting the solution farther off than before.

---

[1] Cf. Shaftesbury's *Letter concerning Enthusiasm.*

The social significance and value of religion should consist, in part at least, in this, that it lifts individuals out of egoistic isolation, or even the competitive relation of business in which the separation of personalities is necessary to the relation itself, into a unity of purpose; a purpose, however, which by its very essence reacts upon motive and feeling, to dissolve the particular self and substitute a self that is inclusive. A Paul, a Spinoza, a Schleiermacher, a Coleridge, all recognize this significance. The religion of the eighteenth century aimed undoubtedly to promote the social unity of its followers, but in making its motives internal it gave them so prudential a form that the unity was but faintly realized.

The industrial forces were doubtless in great measure responsible for another characteristic of the century which was also an important factor in its religious and moral life, namely, the general diffusion of intelligence. The new commercial interest required better roads and more frequent communication. General interchange of views brings with it better understanding and the possibility of 'sympathy'; and the new content of science and discovery, which was waiting to be popularized and become part of the general consciousness, helped forward the freedom of thought which lingered behind freedom of faith and freedom of action.

The literature of the age is too familiar to need more than a passing reference. The greatest genius and most typical figure was certainly Swift, and the aims and motives of man, as he has portrayed them in satire, merely carry the principles of some of the moralists farther than they would care to go. No sane critic would take satire for history, and yet we may find much light upon the moralists' construction of the individual by reading it in more glaring colors, though with distorted drawing. The Yahoo, with his pile of yellow stones, and the politicians of

Lilliput may tell but one side of contemporary life, but it was a side which was first coming forcefully to consciousness and was therefore bound to be reflected in a moral theory that was in touch with men. If Swift was the greatest, he was far from being a complete expositor of the motives and sentiments of his generation. Addison voiced its growing urbanity, Pope its intellectual interest in moral and religious themes, and later Richardson showed sensibility as the dominant aspect of human interest.

SECTION II.

THE NEW ETHICAL PROBLEM, AND THE EARLY APPEARANCE OF THE CONCEPT OF A MORAL SENSE.

If, with Hume, we divide the ethical writers of this period into those who derive moral distinctions from reason, and those who derive them from some impression or sentiment, it is evidently the latter group which best reflects the advance in the conception of the Individual and his social relations. Cudworth, Clarke, Balgny, Wollaston, Price, represented either a preceding stage in the development of the Individual or a conservative criticism upon the new doctrines. They may find inadequacies and one-sided presentations in their opponents, but it is after all in these opponents that the moving forces of the age find recognition. Intellectualism had served its end. As seen at its best in Cumberland and Locke, its service was to free the moral life from subjection to authority, to vindicate for the Individual his sovereignty over nature and his conscious participation in the laws and institutions which confronted and controlled his action. But institutions and laws were no longer supreme in British life. And yet the average man continued to get on in a fairly decent and respectable fashion with his neighbor. If he feared God less, he regarded man more than had his Puritan grandfather, and Intellectualism had no analysis to offer for the new machinery which was carrying on the social and moral system. Not until feeling and instinct had gained recognition could reason again claim its share in the moral life. Shaftesbury and Rousseau must come before Kant; Adam Smith and Mill before Green.

The first expression of the new attitude toward social and ethical problems is usually attributed to Shaftesbury. But while Shaftesbury and his more systematic disciple Hutcheson deserve credit for the extended development and formulation of the doctrines of moral sense and benevolent instincts, we find distinct statements of the essence and even of the technical term in certain divines of whom Tillotson and Barrow may be cited as examples. The transition by which an old concept is made to do duty for the new idea has an interesting illustration in Tillotson's definition of the term 'Light of Nature.'[1] This, with Descartes, had borne the natural meaning of discernment, or intellectual recognition. With Locke and Cumberland, reason was the corresponding principle. But Tillotson defined 'Light of Nature' as 'a natural instinct, by which I mean a secret impression upon the minds of men, whereby they are naturally carried to approve some things as good and fit, and to dislike other things as having a native evil and deformity in them.' Here the 'light' is affirmed to be an 'instinct,' and if the phrase 'approve as good' may seem to imply a judgment which has a rational element, the term 'dislike' is purely a term of feeling; while the word 'deformity' naturally suggests the æsthetic quality which plays so large a part later. The transfer of the moral categories to the realm of feeling is thus well on its way.

Much more explicit statements are found in Barrow,[2] and these take on additional interest from the fact that Shaftesbury was acquainted with the author and speaks of him with esteem.[3] The important points in Shaftesbury's account of human nature are (1) his championship of a social 'herding' instinct; (2) his claim that happiness depends upon having the generous affections strong, and that to have the private affections too strong is to be miserable; (3) the immediacy of the approval or disapproval which we pass on moral acts. This is made analogous to the æsthetic feeling, or sometimes to the more solely sensuous reactions of smell and taste. All these doctrines are explicitly stated by Barrow, the first two in the following:

---

[1] "Sermon 101." *Works* (Vol. V., 273).

[2] Barrow's *Sermons* were published in 1685.

[3] *Letters of a Noble Lord to a Young Man at the University*, 1716.

"Doth not nature by implanting in our constitution a love for society and aversation from solitude * * * dictate unto us that our good is inseparably connected and complicated with the good of others?" "A generosity innate, which disposeth men to serve the public and promote the benefit of society." "Even a true regard to our own private good will engage us not inordinately to pursue self-interest."[1] The 'moral sense' (or 'mental sense,' as Barrow calls it) theory is stated in the following, and from the fact that the paragraph is found in at least two sermons, the doctrine was evidently a favorite with the author:

"The practice of benignity, of courtesy, of clemency, at first sight, without any discursive reflection, doth obtain approbation and applause from us; being no less grateful and amiable to the mind than beauty to our eyes, harmony to our ears, fragrance to our smell, and sweetness to our palate; and to the same mental sense malignity, cruelty, harshness, all kinds of uncharitable dealing, are very disgustful and loathsome."[2]

SECTION III.

THE INDIVIDUAL CONSTITUTED BY INSTINCTS AND FEELINGS. — SHAFTESBURY.

But although the cardinal principles of the new conception of the Individual found an earlier expression, it is no doubt to Shaftesbury that we look for a fuller characterization of the human nature of his time, and for a more direct statement of the new ethics.

1. *The Primacy of Feeling.*

The foundation of the new ethics is to be sought within the Individual and more particularly in his feelings and instincts. The parallel here between Shaftesbury and Descartes is a striking one. This time it was in the sphere of morals that authority had come to be regarded as external and therefore as of questionable validity. Even admitting with Hobbes, Cumberland, and

---

[1] Sermon 62.

[2] Sermon 26. 'On Love of Our Neighbor,' repeated in Sermon 28.

Locke that the State, or the Law of Nature, or Law of God had existence and power which could be recognized by reason and motived by self-interest, the man of integrity might well feel that the deeper springs of the moral life were undiscovered, and that morality so supported was in a parlous state. Shaftesbury, if he had not the awe which a Kant felt in the presence of the moral law, had by inheritance and training[1] a deep appreciation of the inwardness and spontaneity of a real moral life. As the gentleman does not look to books for his rules of courtesy, nor doubt their binding force, so the man of morality is not concerned with the external standards or motives. He finds sufficient basis within: "We cannot doubt of what passes *within ourselves*. Our passions and affections are known to us. *They* are certain, whatever the objects may be on which they are employed."[2]

Furthermore, the feelings are not merely the most intimately known and certain data; they are the essential and most important data for ethics. "A man is by nothing so much himself as by his *temper* and *the character of his passions and affections*." Nothing would have been more abhorrent to Shaftesbury than to be associated, even in thought, with the evangelicals whose 'enthusiasm' he ridiculed. But in attaching primary importance to affections and passions he was really in accord with the religious attitude which made the 'heart' the vital test of character. The allegory of Bunyan, which reflected the subjective side of the more serious religion of the preceding generation, is almost entirely occupied with the Pilgrim's emotional states. The sermons and diaries show a similar importance attached to holy affections.

2. *The Subjectivity of Goodness and Virtue.*

The definitions of goodness and virtue are also in terms of subjective feeling, not in terms of objective conduct or conformity to law. "A sensible creature, is then only supposed *good*, when the good or ill of the system to which he has relation is the immediate object of some passion or affection moving him." The conception of 'virtue,' as distinguished from that of 'good,' implies that the creature can have a notion of a public interest, that he can discern 'the good and ill toward the species or public' and then cannot merely act accordingly, but 'make worth and honesty, an object of his affection.' It is not sufficient for merit and worth that a man have social affections; "a new trial or exercise[1] of the heart must arise by which he loves or admires public affections."

---

[1] This appears particularly in the ἀσκήματα or *Philosophical Regimen* recently published by Dr. Rand. In this the influence of Stoic models of self-discipline is evident.

[2] *Inquiry Concerning Virtue*, Bk II., Pt. 2, conclusion.

It is to be said, however, that while defining good in subjective terms, Shaftesbury does not give the abstractly hedonistic definition of satisfaction. 'The satisfactions of the mind and the enjoyments of reason and judgment' include more than the mere hedonic tone. Nor is 'good' merely what we fancy at the moment; there is a 'real good.' 'That in which the nature of man is satisfied and can rest contented' is 'alone his good.' Shaftesbury thus opposes the nominalism of Locke by a more completely subjective criterion, rather than by an attempt to rehabilitate any abstract conception of reality.

3. *The Individual Naturally Social.*

We have seen how the individual and his virtue are defined. The next question is as to the content of the Individual as thus conceived. What is the nature of the Individual, and what is his relation to society? The answer will be, that while the Individual is recognized more fully as an individual than by preceding writers, Shaftesbury endeavors to give the Individual a far more social content. In this, as will appear later, his method is the converse of Mandeville. Mandeville makes all the 'social tendencies,' if such they can be called, of man the consequence of social forces. Shaftesbury starts his Individuals with a social content but makes no effort to trace this to social forces.

The question as to the Individual's relation to society, moreover, contains an ambiguity which was responsible for much subsequent confusion. Are we to understand by 'Individual,'

---

[1] The term suggests the ἀσκήματα by which Shaftesbury trained himself. Cf. Rand, *The Life, Letters and Philosophical Regimen of Anthony Cooper*, end of Sec. 18.

any Individual, or only the good Individual? In other words, are we asking a question in anthropology as to the attitude and behavior of 'primitive' man, or a question in ethics as to the criterion and motive of the good man? These questions are by no means clearly separated by Shaftesbury, and the liability to confusion is increased by the ambiguity in the words 'nature' and 'natural' which has played so large a part in ethical theory from the Sophists to Rousseau. As illustrative of the first or factual meaning of 'nature,' we have such phrases as 'state of nature,' *i. e.*, antecedent to organized society, and 'men naturally have a share of this combining principle,' where the assertion is that to combine with others is instinctive, not the result of deliberation and well-considered self-interest. The test of the natural in this sense would be originality. Illustrative of the second, teleological, or normative use of the term are the following: 'If anything *be natural* in any creature or in any kind 'tis that which is *preservative* of the kind itself and conducing to its welfare and support.'[1] "What is natural to each is its perfection."[2] In the case of Shaftesbury there was as a further motive for not sharply distinguishing these two uses, namely, the metaphysical optimism, which refused to admit any contradiction between the actual and the ideal.

In both the above senses Shaftesbury maintained that man was 'naturally' social. The 'herding principle and associating inclination' are innate. In opposition to the abstract individualism of Hobbes, Cumberland had made man *objectively* part of a biological and social system. Shaftesbury makes him subjectively such. For with Shaftesbury man not merely *is* a part of a whole; he is voluntarily so. The ties that bind him to his fellows are not external but internal. It is however in the ethical or normative sense that man's natural sociability is more fully analyzed, as Shaftesbury considers the criterion of virtue and its motivation. Passages in which the social content of the criterion is stated have been already quoted.[3] It is only necessary to note that here as in the case noted above in the comparison with Cumberland,[4] the greater subjectivism renders possible a more deeply social content than systems which measure conduct solely by results, even if the standard for results be tendency to public welfare.[1]

---

[1] *Sensus Communis*, Pt. 3, Sec. 2.

[2] *Misc.* 4, Ch. 2. Shaftesbury of course may have taken this from Aristotle.

[3] Above, p. 8 f.

[4] Above, p. 8.

4. *The Egoistic and the Social in Motivation.*

More interesting, because more illustrative of the reciprocal influence of greater individualism in the 'form' of moral life and greater sociability in its content, is Shaftesbury's doctrine of motives. Of motives, for this is the turn which his individualism gives to the question, 'what obligation there is to virtue, or what reason to embrace it.' The motive presented in the *Inquiry*[2] seems at first sight purely hedonistic. To prove the obligation to virtue will be to prove:

> I. "That to have the natural, kindly, or generous affections strong, and powerful toward the good of the public, is to have the chief means of self-enjoyment, and that to want them is certain misery and ill."
>
> II. "That to have the private or self-affections too strong, or beyond their degree of subordinacy to the kindly and natural, is also miserable."
>
> III. And, "That to have the unnatural affections (viz., such as are neither founded on the interest of the kind, or public; nor of the private person or creature himself) is to be miserable in the highest degree."

The line of proof consists in showing that the pleasures of mind are superior to those of the body, and that 'the mental enjoyments are either actually the very natural affections themselves in their immediate operation'; or they are the effects of those affections, such as, *e. g.*, the pleasures of sympathy or of esteem from others. All this seems purely egoistic. A man is urged to embrace virtue merely on the ground that he is thus choosing the most permanent, intense and fruitful kind of pleasure. The ground of appeal would be then purely to individual feeling, and the universal would thus be eliminated entirely from the 'obligation' or 'reason' to embrace virtue.

---

[1] In addition to the social criterion Shaftesbury also introduces a more individualistic and æsthetic standard (doubtless under Greek influence) in such phrases as 'sound,' 'proportionable,' 'intire' affection; but the latter two phrases when employed in the *Inquiry* seem to be social in meaning. They are opposed to 'partial,' or 'unequal' (unjust) affections. In other writings the æsthetic element is more pronounced in such phrases as 'numbers, harmony, and proportion,' and especially in the moralists (Pt. 3 Sec. 2), where it is maintained that beauty and good are the same.

[2] Bk. II, Pt. 1, Sec. 3.

But this is not by any means the whole of Shaftesbury's thought. In the first place, as already seen, the content of virtue is not for him to be defined in terms of pleasure, and so the method of getting this virtue chosen involves first of all a separation between end and motive. Just as Walpole justified bribery on the ground that he bribed men to be honest and patriotic, so this system would appeal to men's self-interest to cultivate the social affections and weal. This divorce between end and motive was not wholly satisfactory to Shaftesbury, and he attempts to correct its inadequacy in various ways. Conduct influenced solely by hope of reward or fear of punishment has 'no virtue or goodness whatsoever,' for 'the will is neither gained nor the inclination wrought upon.'[1] Nor can such fear or hope consist with virtue if it is either an essential or a considerable motive to an act that should have been prompted by some affection alone.[2] Just as a building may be so shored and screwed up on its supposedly weak side as to make it lean the other way, so would-be friends of morals 'have not been contented to show the natural advantages of virtue and honesty,' but have dwelt upon its rewards and made it mercenary. "To be brib'd only or terrify'd into an honest practice bespeaks little of real honesty or worth."[3] The real service which rewards and punishments may render is (*a*) the negative one of restraining vicious passions sufficiently to give virtuous impulses a fair chance, and (*b*) the positive educational functions of expressing the judgment of the community and of habituating the individual to an exercise of affections in which he may come to delight for their own sake.[4]

These doctrines involve an abandonment of the position that motive and act can be entirely separate. The inquiry in its main line of argument relies on the intrinsic pleasure found in virtuous affections, and it is obvious that the ultimate ground for insisting on the inseparable union of public and self-interest is largely the metaphysical optimism which cannot hold to a fundamental contradiction between part and whole.

[1] *Inquiry*, Bk. 1, Pt. 3, Sec. 3.

[2] *Inquiry*, do.

[3] *Sensus Communis*, Pt. 2, Sec. 3.

[4] *Inquiry*, Bk. 1, Pt. 3, Sec. 3.

5. *The Sensus Communis as a Trans-subjective Faculty.*

But we are as yet still appealing to the Individual's feeling as motive and ground of obligation, and hence seem to make pleasure and pain the ultimate criterion. The doctrine of a 'sense,' taken in its full implication, goes beyond this criterion. It is advanced in opposition to those who would 'rate life by the number and exquisiteness of the pleasing sensations.'[1] It means a sense of what I owe myself and what becomes me as a human creature.[2] A 'right taste' must be '*formed*.'[3] It does not necessarily coincide with choosing what pleases; our 'better' or 'nobler self' expresses itself through a 'taste' or 'sense' of this sort.[4] The moral sense or right 'taste' is therefore to Shaftesbury a medium through which the objective moral universal may voice itself. It is the representative in his subjective standpoint of the objective beauty and good of the Greeks and of the objective political relationship maintained by Aristotle and Cumberland. It is that recognition of some universal which every moral theory must make in some form; but the fact that a 'taste' or 'sense' is presumptively so individualistic a canon of judgment made it easy for Shaftesbury's critics to deny that his system recognized any moral standard at all, and the ambiguity in the term 'nature' which has been noted above gave an additional point of attack. Shaftesbury's real contribution to the ethical theory of his time was his affirmation of the Individual who is inevitably social in feeling and instinct. The explanation and analysis of the sociability was reserved for others.

SECTION IV.

THE INDIVIDUAL AS THE OUTCOME OF EGOISM DIRECTED BY THE PRESSURE OF SOCIAL FORCES. — MANDEVILLE.

Mandeville recognized even more clearly than Shaftesbury the new Individual of the social, economic and moral world. He delighted in paradoxes based on the contradictions in standards which the new Individual suggested. The chief significance of Mandeville for our purpose is that he regarded this new Individual as a product, to be explained by social and economic forces, not as a unit by which to explain society.

---

[1] *Sensus Communis*, Pt. 3, Sec. 4.

[2] *Ibid.*

[3] *Advice to an Author*, Pt. 3, Sec. 3.

[4] *Ibid.*, Pt. 3, Sec. 1.

1. *The Conflicting Ideals in the Modern Individual.*

Mandeville recognizes the new Individual. Partly, it may be, from his own cynical disposition he found the individual of the modern world a more narrow and material being than the optimism of Shaftesbury had depicted. But it cannot be denied that he also discovered contradictions, overlooked by his more genial predecessor, which brought out more forcibly the character of modern economic standards and motives. Shaftesbury, in order to interpret the modern spirit and at the same time give ethical sanction to what he regarded as its most positive features, had effected a transition in the concept of virtue analogous to that made by Hobbes in the concept 'right.'[1] He made it stand for a power rather than for a control. Mandeville acutely points this out. "The generality of moralists and philosophers have hitherto agreed that there could be no virtue without self-denial; but a late author * * * is of a contrary opinion, and imagines that men without any trouble or violence upon themselves, may be naturally virtuous." As an actual force in directing conduct the 'honor' of the 'noble' man or 'gentle' man had been far more potent than its lack of prominence in ethical writers would imply, and the fundamental affinity between the spirit of the Renaissance and that of Greek culture had made it easy for the English gentleman to appropriate as his ideal the Greek conception of harmonious development. But this as interpreted by most men of the world involved quite a different standard from that set by the religion which had furnished the ideals of the Middle Ages.

> "The one bids you bear injuries with patience; the other tells you if you do not resent them, you are not fit to live. Religion commands you to leave all revenge to God; honor bids you trust your revenge to nobody but yourself, even where the law would do it for you: religion plainly forbids murder; honor openly justifies it: religion bids you not shed blood upon any account whatever; honor bids you fight for the least trifle: religion is built upon humility, and honor upon pride."[2]

[1] *Univ. of Chicago Cont. to Philos.*, No. 5, p. 19.

[2] *Fable of the Bees*, Vol. I., p. 162. [Edin. ed. 1772.]

Moreover, the generation of Mandeville was not merely rejecting the puritan religious standard in favor of the honor of the gentleman. It was measuring its values in more sensuous and less transcendental terms. 'Real pleasures, comforts, ease' were the goods of the new commercial life; and 'real pleasures' mean 'not those which men say are best, but such as they seem to be most pleased with.'

It was further characteristic of this, as of many other periods, that the more material standard was more frankly and unabashedly admitted for the public than for private life.

In order that a nation may be happy and flourishing, Mandeville argues, there must be both continuous and varied production. Continuous production can be secured only by the economic motive of desire for wealth on the part of the laborer; varied production, if it is to have value, implies varied wants on the part of consumers, and this is but another name for luxury. Egoistic self-interest and sensuous enjoyment are thus seen to be essential to the national weal. Reference to this public weal as a standard was, however, quite in accord with the tendencies of the contemporary ethical theories, and gave the point to the paradox, 'private vices, public benefits.' Mandeville was but stating the motives on which the statesmen relied to foster national wealth. It is beside the mark, so far as this inquiry is concerned, to consider the economic soundness of his argument, the important thing is that he formulated a contradiction involved in the changed values and ideals of the age.

2. *The Moral Resolved into the Merely Social.*

If 'honor' is really the standard of the new individual, then it is possible to give an explanation for both the content and the motives of morality. Honor, as viewed by Mandeville, means that part of myself which consists in what others think of me. It is then not necessary to assume any specific moral instinct in the individual. All that is needed is a regard for the praise or blame of others. It may be objected that this is but to substitute one instinct for another as the foundation of the moral life. True, but Mandeville may claim that he is using a simpler 'instinct' and one which certainly exists. Regard for the social judgment is at least a *vera causa* in mediating the transition between the 'cosmic process' and the 'ethical process,' and Mandeville's exaggerations should not blind us to his service to social psychology in emphasizing this force. In stating the way in which the social judgment has come to enforce those particular requirements which constitute what we call virtue, Mandeville of course contrives to give just enough distortion to obscure the truth. Priests and politicians have 'invented' the scheme of praising certain acts which conduce to the good of the state and calling these virtuous. Modern social psychology must smile at the idea of 'inventing' virtue as if by conscious artifice. But if we vary the emphasis slightly, is not this what has taken place? Men of higher religious ideals and larger political sagacity have always been slightly in advance of the bulk of the people in formulating the demands of society upon the individual, and aiding the vague feeling of the group to crystallize in definite judgments.

3. *The Elements in Man's Alleged Sociableness.*

The same effort to explain the Individual as a product of social pressure rather than as a social unit is seen in Mandeville's account of the alleged sociableness of man. Shaftesbury had assumed a 'herding' instinct to explain the origin of society. Mandeville admits that man may be called a 'sociable creature,' but denies that this is due either to immediate instinct or to love for society. "The sociableness of man arises only from these two things, viz., the multiplicity of his desires, and the continued opposition he meets with in his endeavors to gratify them."

The framework of the structure is economic. The bones and sinews of the body politic are to be sought in the varied wants of men and in the differentiation of labor educed by these wants. If man could gratify all his wants without exertion and with no help from his fellows the complex societies of civilization would never arise. The love of society is thus rather an acquisition than a primitive affection. It is based on intelligent self-interest rather than on instinct. So far as it exists at all it is a product of society rather than its cause. Even the multiplicity of desires which forces man to seek the aid and company of his fellows has a social cause. It is society itself which arouses these multiform desires and brings about the mutual dependence of men upon each other. "*Men become sociable by living together in society*."[1] "The most civilized people stand most in need of society, and none less than savages."[2] This is conceiving the social man as a product of economic conditions. Aside from this primary motive force of desires which drives man to seek the help of his fellows, the principal qualities which make man capable of society are his capacity for thought and speech, his pliableness[3] or docility, and his longevity. It is through these that men are rendered 'governable,' and it is in being 'governable' rather than in being fond of company that the essential prerequisite for society is found. It is, upon presenting motives appealing to the intelligent self-interest of the citizens that statesmen rely in maintaining the stability of societies already founded. It is, therefore, 'what we call evil' (*i. e.*, economic motives) rather than the 'good and amiable qualities' that make man preëminently sociable.

4. *The Moral as Generated from the Economic.*

Mandeville is thus able so to interpret the moral and political life of his day as to find a third view of human nature, which borrows from both puritanism and commercialism and yet differs from the theories of both Hobbes and Schaftesbury. According to puritanism and Hobbes man in a state of nature is neither moral nor social. According to Shaftesbury he is 'naturally' both. On this issue Mandeville sides with puritanism and Hobbes. He does not agree that men are 'naturally virtuous.' The agencies by which the moral and social life is actually attained, are, on the other hand, quite differently conceived in the three systems. According to puritanism, the transition is effected only by a supernatural process of conversion; according to Hobbes it is by fear of violence; according to Mandeville[4] it is by economic motives of advantage to be

[1] *Fable of the Bees*, Vol. 2, p. 157.

[2] *Ibid.*, p. 150.

[3] Cf., 'plasticity,' or 'adaptation' in Baldwin's *Mental Development*.

[4] See his criticism quoted above, p. 14.

gained, or by the subtler motives of honor and pride. Puritanism reflects the belief in divine sovereignty, Hobbes the era of violence, Mandeville the age of commercialism and social influence. To the Puritan the path of virtue lay through self-denial; because he was convinced that the natural self — the self of desires for wealth, place and power — was bad. Hobbes likewise assumes a certain sort of self-surrender as the basis of society, namely the surrender of individual rights (powers). Mandeville, while availing himself of the Puritan theory of nature and virtue, and thus plausibly placing himself on the side of a higher standard of virtue than that set by Shaftesbury, avails himself also of the Hobbist motives of gain and glory as the means of socialization. Hence the self-denial required in his system is the 'apparent self-denial' involved in economic or prudential action.

SECTION V.

THE INDIVIDUAL ENLARGED BY THE CAPACITY TO EXPERIENCE PLEASURE IN WITNESSING OR DOING ACTS NOT YIELDING HIM PRIVATE ADVANTAGE. — HUTCHESON.

1. *The Individual's Moral Sense as a New Avenue of Pleasure.*

"One man says, he has a thing made on purpose to tell him what is right and what is wrong; and that it is called a moral sense."[1] Such might naturally seem to be the function of a moral sense, viz., to serve as a criterion. But this is precisely what Hutcheson does not emphasize as its function. The prevailing criterion of actions in Hutcheson's system is in words just what it is in Bentham's, viz., usefulness to the public.[2] The function of the moral sense is rather to explain why usefulness to the public should enlist the approval of the individual — a question which apparently did not occur to Bentham. In assigning this function to the moral sense Hutcheson is more closely in accord with Barrow than with Shaftesbury. For the latter had made its function rather the negative task of disapproving unseemly acts. Hutcheson gives it a positive place, and makes it perform the service of mediating between a hedonistic psychology and the social judgments of approval and disapproval.

---

[1] Bentham, *Introduction to the Principles of Morals and Legislation*, Ch. II.

[2] In the *System*, Bk. II., Ch. 3, ii, Hutcheson affirms that "The righteousness or goodness of actions is not indeed the same notion with their tendency to universal happiness, or flowing from the desire of it. This latter is the highest species of the former." But in both Inquiry and System the tendency toward the happiness of some other than the agent — whether it be universal, or less extensive — is always prominent as the criterion.

Hutcheson has a much more definitely psychological purpose than Shaftesbury. Like Shaftesbury, he makes the feelings and affections the essence of moral personality. Like Shaftesbury, he conceives the moral judgment in æsthetic categories. But the question as to why an individual should find pleasure in the benevolent actions of others presented itself to Hutcheson as needing a special examination. To an intuitionist our approval of benevolent actions might seem the immediate consequence of our recognition that such acts are right, but Hutcheson expressly disclaims any innate ideas or innate knowledge of right or wrong. A Mandeville might attribute all moral approvals to the craft of politicians who had persuaded men to approve acts tending to the public good, although these acts might be of no use to the individual judging; but while the social nature of the judgment impressed Hutcheson, the transition thus effected from egoism to morality seemed too palpably artificial. The explanation that acts benefiting the public must necessarily benefit us in some degree, and hence that our approval of benevolent actions springs from egoistic satisfaction, that all gratitude is a 'lively sense of favors yet to come,' seemed equally far fetched. Hutcheson therefore urges that just as we experience pleasure from our perceptions of natural good (*i. e.*, advantage) and from perceptions of beauty and harmony, so we must suppose another avenue of pleasure to account for moral approval of actions which in no way relate to our natural good. This avenue of pleasure he calls the moral sense.

Now we may smile at the simplicity of the device by which an 'occult quality,' as Hutcheson himself called it, is presented as a solution for the question. We might even consider that Mandeville's clumsy use of social psychology pointed to a more fruitful line for further inquiry; but the fact remains that although Hutcheson's solution is itself but another statement of the prophecy, it is a far more adequate statement of the issues involved than had previously been made. The individual is still conceived in terms of feeling. His moral judgments must rest on feelings of pleasure or pain. But his pleasure and pain need not be egoistic. If there is no conception of the intricate and subtle analysis which shows the self to be social, there is at least a conclusive argument that the happiness of others can make its immediate appeal to our consciousness and find recognition in our moral approval.

2. *The Deeper Moral and Social Implication of 'Honor.'*

That the fundamental function of the theory of a moral sense is to enlarge the conception of the Individual's nature is further seen in Hutcheson's explanation of 'honor.' He is willing to give to this passion one of the highest places among the forces of human life, but he claims, as against Mandeville, that the regard for the opinion of others, evinced in the sense of honor or of shame, presupposes the existence of a moral sense. Mandeville had postulated a regard for the opinion of others as a fundamental human quality. Hutcheson replies that such a regard implies some other principle in human nature than that of self-love. For why does my pleasure and pain depend on the good opinion of others? If it be said that it is because we gain or lose by such opinion, the answer is that the feeling of loss is one thing, that of shame another. We often lose without feeling ashamed. Of course, what Mandeville and Hutcheson both have in mind is that the self has as part of its content the opinions of others. As between their interpretations one is psychologically about naïve as the other. Each postulates a faculty. The difference is that Hutcheson's explanation attempts to do justice to a deeper element in the sense of honor and shame than was perceived by Mandeville. Hutcheson points out that we do not honor the man who acts merely from regard to honor, nor do we necessarily honor the man who acts advantageously toward us, our party, or even our country, unless we suppose a love of the public on his part. Hence in honor-ing a man we really identify ourself with the public, and a sense of honor implies a similar appeal to the public point of view. Most important of all, it is an appeal, not to the actual social judgments pronounced by public opinion, but to the judgment of a real social self, corresponding to the idea of a real public good. Honor, then, implies a true universal; it implies that the self which is here seeking recognition finds its true *Socius* only in an ideal social unity and not in the actual uttered opinions of present society.

3. *The Individual's Capacity for Disinterested Benevolence.*

The moral sense means a broadening of the Individual on the receptive or appreciative side. The theory of 'disinterested benevolence' means a similar broadening of the individual on the active side. In the latter, as in the former, Hutcheson supports and develops by a deeper psychological analysis what Shaftesbury had suggested. The prevalent theory of the day was undoubtedly that self-love, in open or disguised form, is the spring of all our actions. It is further to be noted that Hutcheson himself defines it as the 'principal business of the moral philosopher to shew from solid reasons that universal benevolence tends to the happiness of the benevolent; that so no apparent views of interest may counteract this natural inclination.'[1] The important point is that benevolence is held to be a natural inclination which cannot possibly be produced by any devices of an artificial sort. It may be counteracted by views of self-interest, but it cannot be produced by such views. Hence, if there is any such thing as benevolence at all it cannot be explained as due to self-love in open or disguised form. For 'desire does never arise from a view of obtaining that sensation of joy connected with the success or gratification of desire; otherwise the strongest desires might arise toward any trifle.'[2] Further, desire of the happiness of others cannot be evoked by the opinion that such a desire would be advantageous. This might make us wish to have the desire; it could not give it to us.[3] Otherwise we might be bribed into loving or hating, which is absurd. Suppose, however, this be granted, and the admission made that no extrinsic pleasure or pain can move us to genuine benevolence, a subtler question presents itself in the query whether it may not be because the public interest is our own, that we love the public just as we love our children because they are 'parts of ourselves.' Hutcheson's reply to this shows genuine acuteness. "How are they parts of ourselves? Not as a leg or an arm: we are not conscious of their sensations. It is love which 'makes them parts of ourselves,' therefore it does not flow from their being so before."[1] This is a clear recognition that the term 'self' includes far more than certain sensuous interests connected with the body, or certain exclusive interests of any sort. It may become as inclusive as the range of our affections. As pointing toward the modern psychological view of the self as not a fixed entity but a complex and organized system of desires, interests, ideals, purposes, and habits, the passage is one of the most significant in the ethical theory of the century.

---

[1] *Inquiry*, Sec. VII., ii.

[2] *On the Passions*, Sec. 1, p. 16.

[3] *Ibid.*, pp. 17 f.

SECTION VI.

THE PARTICULAR IMPULSES AND FEELINGS RELATED TO THE SELF. — BUTLER, JOHN CLARK.

The Individual has thus far in this period been treated mainly as a being of feelings and impulses, or of calculating in the interest of feelings, and played upon by social forces. An ethical standpoint which does fuller justice to the unity of the individual and brings the opposing claims to a temporary adjustment is taken by Butler. For in the first place he raises the controversy between benevolence and self-love to a new level by distinguishing the impulsive from the considerate disposition and action; secondly, he gives to reflection and reason its place in unifying the self and constituting the responsible aspect of the individual; and thirdly, he attempts on this basis a distinction between power and authority, between motive and obligation, which points toward a teleological basis for obligation, even though it does not reach it. This last distinction leads Butler to clear up that ambiguity in the terms 'nature' and

---

[1] *Inquiry*, Sec. II., ix.

'natural' which was found in Shaftesbury and exploited for his own argument by Mandeville. Butler's Individual is not limited to impulses and affections on the one hand, nor to reason functioning only in the calculation of material or social advantage on the other. The self is indeed the ultimate center of reference. So far the 'selfish theory' was sound; but the self is not limited to the narrow and exclusive self of gain and glory — in this the right lay with the other party. Finally, the decisive voice in determining which impulses ought to prevail in the self to be realized, and which ought to be repressed, is not a voice of impulse but a voice of reflection.

1. *The Economic Category of Interest Distinguished from the Moral and Social.*

Butler's distinction between particular affections which rest in their objects, and 'cool self-love' which considers all these particular affections as means to happiness, is familiar. For our purpose the important point is the interpretation of this distinction in terms of the conception of the Individual. The previous discussions had for the most part taken 'self' as a fixed entity. The content which men had in mind when they argued that an act was interested or disinterested, was that of material interests or of power and distinction. The element of truth which is given a mistaken interpretation in egoistic hedonism is that the Individual must freely choose his end. This involves that a given choice is made because on the whole the object sought appeals to him as most desirable, or in ordinary phrase the man does what pleases him. The strain involved in maintaining that a man does a benevolent act solely to please a material or ambitious self was severe, but this was the position taken by Mandeville, and he was but stating current political and commercial theory in exaggerated form. Shaftesbury, indeed, had argued that to have the public affections strong is to have the chief means and power of self-enjoyment, but he had conceived the individual so fully in terms of feeling that his principle might be stated, 'social pleasures are superior in quantity to non-social pleasures.' This would be to estimate the value of social affections in terms of pleasure-pain and might make it appear that conduct was merely a choice of pleasures, a choice which might vary with individuals. To guard against such an inference Hutcheson had insisted upon the disinterestedness of benevolence. But this seemed to imply that the benevolent man either had no delight in his benevolence, or at least did not find his satisfaction in benevolence, and chose it because it satisfied him. Hutcheson seemed therefore forced to separate man's benevolence from the self. The dilemma which now confronted ethics was this. To be truly benevolent, acts must not be referred to myself. But unless I do such acts because they appeal to me and promise satisfaction, then they are not fully mine, and I am not in the fullest sense benevolent. For in the latter case the act would be either unmotived or appeal to motives outside me. If unmotived the act would be merely impulsive and so not ethical. If due to motives outside of me (were such a case conceivable) it would not express my character or be properly my act.

Butler met this dilemma by a distinction which on the one hand broadened the concept of the self, and on the other raised the self to a higher unity than that of feeling. He points out with great acuteness the false analogy from property which was so influential in current ethical theory. Economic interests are always liable to be conceived as mutually exclusive, and in Butler's day national economics had this conception as an implicit basis. The economic relations had not yet been made the subject of special study to such a degree that a distinction between economic value and moral value was brought to clear recognition. Like mind and matter prior to Descartes, neither was made sufficiently abstract to be clearly conceived. And as in the Middle Ages the ethical had controlled the economic, as is illustrated by conceptions of usury, so in Butler's day the economic was dominating the ethical. "People are so very much taken up with this one subject (*i. e.*, property), that they seem from it to have formed a general way of thinking, which they apply to other things that they have nothing to do with." This 'economic fallacy' leads men to confound the exclusive and competitive economic interests with the social and mutual interests of the moral sphere. They forget that the very meaning of a moral life implies community of interests. They reason, "If property and happiness are one and the same thing, as by increasing the property of another you lessen your own property, so by promoting the happiness of another you must lessen your own happiness." Against such a mistaken notion it is sufficient to point out once for all that happiness means the gratification of certain impulses or desires, and that love of our neighbor is one of these. This may indeed compete with some other interest, just as an interest in wealth may compete with a desire for fame; but this is not a competition between the self and another, it is a competition within self.

This same distinction serves to correct Hutcheson's one-sidedness. Benevolence merely as impulse is not due to self-love; it may be opposed to it. But so may the excessive degree of any natural impulse. On the other hand, it is equally true that benevolence as a 'virtuous principle' and not merely a 'natural affection,' implies an endeavor, an act of will. To gratify this endeavor produces pleasure; it satisfies the self as truly as does the gratification of any other desire. Even further, such is the sovereignty of the self, such its demand that all its acts shall appear as motived within, and so as fully its own, that 'though virtue or moral rectitude does indeed consist in affection to and pursuit of what is right and good, as such, yet * * * when we sit down in a cool hour we can neither justify to ourselves this or any other pursuit till we are convinced that it will be for our happiness, or at least not contrary to it.'

It is not maintained that Butler's distinction is psychologically adequate. To say that the particular affections rest in their objects does not afford an answer to the question as to the nature of reflective desire as distinguished from these objective impulses. Nor does Butler state what part the rational self may take in constituting objects of desire. He falls back on the position that we are 'constituted' with a certain number of impulses, among which is the benevolent. But his distinctions between economic and moral interests and between the objective particular impulses and the inclusive, reflective self, were positive steps in advance.

2. *Reason as a Unifying Principle.*

Butler gives reason a function in unifying and controlling the various elements in the self. It is customary to think of conscience in Butler's system as a successor to the 'moral sense' of Shaftesbury and Hutcheson. But although conscience does exercise an approval and disapproval, it would be as inappropriate to suppose conscience to be merely a faculty invented for that purpose, as it would be to regard Hutcheson's 'moral sense' as such. Just as we saw that Hutcheson's 'moral sense' had as its primary function to enlarge the capacities of the self for receiving pleasure, so conscience enlarges and dignifies the self by restoring to reason a place in the conception of the individual. The moral sense writers had practically ignored the rational element in moral conduct. In the theories of Locke, Hobbes and Mandeville, reason had figured as an agency for finding means to secure pleasure or avoid uneasiness. It had in itself no part in constituting ends. Cumberland had given right reason a place of authority, but for Cumberland reason was a faculty for apprehending an objective rational order of the universe. It was not primarily an internal principle. Conscience, or the 'principle of reflection,' is in the first place, as compared with the moral sense, a rational principle. It is not of course to be identified with reason pure and simple. It may be regarded as including both a 'sentiment of the understanding' and a 'perception of the heart.' Its approval of justice, veracity, and regard to the common good is spoken of as an immediate rather than as a mediate pronouncement. But on the other hand, we have to notice that 'principle of reflection' is nearly always used as an alternative. 'Our perception of vice and ill-desert,' it is said, 'arises from, and is the result of a comparison of actions with the nature and capacities of the agent.'[1] We 'reflect upon our own nature'; conscience points out to us in some degree, 'what we are intended for,' and a fragment speaks of subjecting 'all my passions and affections to my reason.' All this indicates the prominence of the rational, mediate character of conscience. The refusal to identify virtue with benevolence and thus make happiness or misery the sole criterion of moral value is on its negative side in accord with the above, but Butler does not explicitly say that the ground for this refusal is that this criterion would ignore the rational factor. He merely asserts that justice and veracity have intrinsic value and must not be followed or rejected on the basis of the assumed tendency to happiness or misery.

---

[1] *Diss. on Nature of Virtue.*

As contrasted with the function assigned to reason by Hobbes and Mandeville, this rational or reflective principle is not an agency for calculating private advantage. It is decidedly social in its implications, since it is not to be identified with self-love. Self-love may claim the primacy so far as motivation is concerned, since every act must ultimately be related to the self; but in deciding *what* self shall be furthered, or what we shall do, conscience must have the decisive voice. If 'duty and interest are perfectly coincident,' it is because man is essentially social and can therefore find his true welfare only in obedience to a reason which prescribes regard to the relations of society.

Finally, as contrasted with the right reason of Cumberland, Butler's 'reflective principle' is an internal principle of control, rather than a medium for apprehending an external and objective system of order and relations. Butler does not question the existence of such an objective system of nature, nor even the possibility of basing ethics upon it; but it is upon human nature that he bases his own system, and though he does not doubt the coincidence of results reached by the two methods, he does not rely upon the first to fix the laws for the second. The origin of our constitution may be due to God; but, having been constituted once for all, human nature henceforth exists as a law unto itself. It is autonomous.

3. *The Individual as Source of Moral Authority.*

Butler's distinction between power and authority is an attempt to recognize the universal aspect of the individual as against two opposing conceptions. First, as against Locke and the older school it denied that all authority must come from some external command. Man may be a law unto himself. It is highly interesting to note that Locke had reached this principle of inner authority in political theory, as being other than the mere power with which Hobbes had endowed his units. He had made each individual 'born to command.' The political revolution had forced men to the theory of democracy. But Locke had not taken a corresponding step in ethics. God has a 'right' to impose a law because we are his creatures; the 'obligation' to obey this law is not further accounted for except through the theory of motives or sanctions. Butler does for ethics what Locke, following Milton,[1] had done for politics. As Locke's individual is born to command, so Butler's conscience or principle of reflection has a 'natural supremacy.' As the authority of government needs not any supernatural source in divine right, but may derive sufficient sanctity from its units, so with Butler human nature has within itself ample authority. There is indeed no such emphasis placed upon autonomy as is the case in Kant's system. There is no analysis of the will such as that by which Kant shows the authority of ends which have intrinsic and absolute worth. The term conscience may be less desirable in its suggestions than Kant's practical reason, and Butler appears more ready to assert the authority of conscience than to explain it. But making allowance for all this, it remains true that Butler conceives conscience as the unifying principle of human nature. It is by its reflection that the due place of every element and the legitimate degree of every passion or activity is settled, and hence it may not unfairly be said that its authority is virtually that which the whole must exercise over its parts, the end over the means.

Secondly, as against certain aspects of the theory of Shaftesbury, Butler's distinction between power and authority meets the criticism of Mandeville, that to make virtue 'natural' was to destroy its essential character. Shaftesbury, as noted above, had not placed all impulses upon the same footing. He had urged that in deciding what is 'natural' we must have regard to the end or welfare of the species as a whole. He had insisted on the need of due proportion. And yet he had viewed this proportion largely from an æsthetic standpoint, and in deciding what should constitute the end of the species as a whole little account is made of rational and volitional elements. The nearest that he comes to a recognition of a universal to which the individual is subject is in his principle of 'taste.' Butler, by emphasizing the rational character of his reflective principle, finds a controlling principle which is universal and authoritative because it alone is competent to unify the self and speak for human nature as a whole; while at the same time it is individual because it finds its content not in external or abstract relations, but in the material of human passions and affections. When pressed as to what constitutes the obligation to obey this principle, his first reply is like that of Kant: 'Your obligation to obey this law is its being the law of your nature'; but in part perhaps out of deference to the hedonistic psychology of the time, in part it may be from recognition that reason is not in itself, if taken abstractly, a motive, he adds that the path of duty must be the path of ultimate satisfaction. "It is manifest absurdity to suppose evil prevailing finally over good."

---

[1] J. H. Tufts, *Univ. of Chicago Cont. to Philos.*, No. 5, p. 47.

4. *Self-satisfaction a Necessity of Moral Action.*

The critique of Hutcheson undertaken by John Clarke of Hull was based upon an analysis somewhat similar to that of Butler, but with emphasis upon another point. It has also a peculiar interest in that it propounded the principle of sympathy as an explanation for the phenomena of 'disinterested benevolence.' Whether this came to the notice of Hume is uncertain, but the use of the principle is certainly worthy of remark.

First as to Clarke's theory of desire. This aims to show that Hutcheson's theories of the moral sense and of benevolent impulses may both be taken up into the hedonistic scheme. He admits freely the contention of Butler and Hutcheson that a desire for pleasure affords no explanation of the various particular impulses or appetites. 'The pleasure received by the taste [of fruit] does not arise from views of self-interest; that's nonsense to say'; and it may be equally admitted that there is an immediate pleasure felt in the contemplation of a virtuous character, and in the union of virtue and happiness. This granted, however, it is no less certain in Clarke's opinion that the man who has once experienced these pleasures will seek to have them again, and will be moved in this by self-interest.

He sees very clearly that if an action is to be mine, I must seek the object to be attained and must feel an interest in this object. "In no case can the mind be affected with a concern for the happiness of others (which is only another name for benevolence) but where *it is brought home to itself* and, some way or other, either immediately, or by consequence, *made a part of its own*, in reality or supposition."[1]

Clarke even turns the tables upon the advocates of disinterested benevolence, by raising the question whether God does not 'delight or take pleasure in doing good. Without this supposition I understand not, for my part, in what sense He could be called a good Being.' If it is alleged that the motive to action may not be this pleasure or delight, Clarke replies that then the act becomes a merely mechanical act or, at any rate, one which does not enlist the interest of the self, and the act of beneficence is not, in any proper sense, a benevolent act.

In the second place, as already indicated, Clarke has a brief allusion to the principle of sympathy, and he uses the principle in a way which is certainly akin to its use by Hume, although it is, to be sure, merely a hint, rather than a fully worked out theory. We have seen that Hutcheson maintained the love of parent for child to be 'antecedent to the conjunction of interest, and the cause of it, not the effect.' Clarke maintains that the interest is already there and that the identification of the parent's own welfare with that of the child is not due, as Hutcheson had claimed, to an affection on the part of the parent, but rather to a purely psychological or even physiological cause. God 'has thought fit to so mould and fashion the human mind, that the parents, by a strange and surprising sympathy, should be very deeply affected with the pleasures and pains of their offspring, receive a most wonderful satisfaction in the former and as terrible a disturbance from the latter, and so be obliged by the very principle of self-love, to take care of their issue, and provide for their happiness, in order to secure their own.'

We note here that sympathy is conceived entirely as a principle for transmitting pleasure and pain from one individual to another without implying any real identification of interest or anything that could properly be called love. In this respect, therefore, it is entirely upon a par with Hume's conception of the principle, and while there is no attempt made to use it as a universal solvent for all our public interests, we have clearly a suggestion which might be utilized by a later thinker of the acuteness and psychological genius of Hume.

---

[1] John Clarke, *Foundation of Morality*; cited Vol. II., page 230 in Selby-Bigge's *British Moralists*.

SECTION VII.

THE MORAL INDIVIDUAL EXPLAINED BY THE PRINCIPLES OF ASSOCIATION AND IMITATION.—GAY, HARTLEY.

The cruder forms of the selfish theory had been driven from the field by Shaftesbury, Hutcheson and Butler. Even such later hedonists as Paley and Bentham assumed a social criterion for conduct, although they resorted to egoistic motives to explain how an individual could be led to act in accordance therewith. But admitting that man has a 'moral sense' or a 'conscience,' is this ultimate or derivative? The genesis of the moral individual was the problem of the writers who follow Hutcheson and Butler.

The familiar analysis made by Gay and Hartley need not detain us long. Both writers assume the existence of a 'moral sense' as claimed by Hutcheson, but seek to explain its disinterested approvals by (*a*) imitation of the judgments of others, and (*b*) association.

1. *The Self of the Purely Analytic Method.*

Gay concerns himself chiefly with showing that all public affections and supposedly disinterested approvals are due to the tendency of the mind to make into an end what is originally only a means. Love of virtue, like love of money, is originally due to pleasure-giving power. Private happiness is the only 'real good.' Obligation is the necessity of doing or omitting any act in order to be happy, and the individualism of his standpoint comes out clearly in his query, "How can the good of mankind be any obligation to me, when perhaps in particular cases, such as laying down my life, or the like, it is contrary to my happiness?"

Gay's individual is thus conceived as governed wholly by egoistic motives in so far as he is rational, and as lapsing into disinterested approvals only in so far as he forgets or neglects to use his reason. Love of virtue, like love of money, is acquired, and no intrinsic criterion is suggested for regarding one as superior to the other. Gay is evidently at the mercy of the analytic method. He conceives his task accomplished when he has resolved the complex into its elements, without giving any criterion to decide whether the whole is greater than the sum of its parts, or is merely equal to it.

2. *Association as a Synthetic Principle.*

Hartley is free from this entanglement in his method, so far as concerns the values of the moral sentiments. For although all the pleasures of sympathy and the moral sense are built up by association, or by education and imitation, from the elemental pleasures of sense, yet 'that which is prior in the order of nature is always less perfect and principal than that which is posterior, the last of two contiguous states being the end, the first the means subservient to the end.'[1] Psychological genesis is one thing; a rule of life is another. Further, as regards the specific problem of the relation of self-love to benevolence and the moral sense, although all such affections and approvals were 'originally founded on a sense of private happiness,' 'the selfish passions convert into benevolent ones,' 'moral pleasures more excellent in their kind than either intellectual or sensible ones' result from 'acting conformably to justice, veracity, faithfulness, etc.'[2] Indeed, Hartley goes so far in this direction as to adjudicate the respective claims of self-interest and self-annihilation to be the basis of morality, by a sort of euthanasia of self-interest; 'though it be impossible to begin without sensuality and sensual selfishness; * * * yet we ought never to be satisfied with ourselves till we arrive at perfect self-annihilation, and the pure love of God.'[3] Association becomes, therefore, in

---

[1] *Observations on Man*, Pt. II., Prop. L.

[2] *Inquiry into the Origin of the Human Appetites and Affections showing how each arises from Association*, 1747 (in Dr. Parr's *Metaphysical Tracts*), pp. 98 f., 125, 131. I assume that this was written by Hartley.

[3] *Observations on Man*, Pt. II., Prop. LXVII.

Hartley's system the psychological agency for affecting the regeneration of the selfish and sensual individual. The view of puritanism and Hobbes and Mandeville as to man's original state persists tenaciously, but we now have a fourth means for rescue; association is a 'friend to grace.'

Obviously the important problem is as to the means and completeness of the transition from the sensuous and selfish individual to the moral and sympathetic member of society who pronounces approvals according to a social standard, and acts with disinterested benevolence. Hartley takes it very easily. In the case of voluntary agents who are, or may be, ministers to our happiness, we approve acts tending to promote our happiness; then we approve all similar acts and thus (?) all moral character. Or, rather, we are taught such approbation, and later see 'the reasonableness of annexing such dispositions to certain particular acts of our own and others.' That this would explain at best only the relatively unreflective judgments, and would fail utterly in the case of the individual who was shrewd enough to analyze his reasons for approval, seems to have escaped Hartley entirely, owing perhaps to his own placid and genial disposition. His attempt to account for the normative value implied in the term 'merit' can be regarded only as a curiosity. "Whoever performs an action with a view to obtain some certain end hath a right to the end for which such action was pursued: and consequently every action merits that for the acquiring which it was first undertaken." "Merit therefore is the right we have to the approbation of others from our voluntarily contributing to their happiness."[1] The difference between a right and a claim, between a social and an individual attitude, has evidently not occurred to the genial author. To resolve such normative and universal judgments as those of morality and justice into simple elements needed a subtler genius, and a wider vision for the forces of human nature. Such a genius and vision were combined in David Hume.

---

[1] *Inquiry*, Sec. IV.

SECTION VIII.

THE MORAL AND SOCIAL INDIVIDUAL EXPLAINED BY THE PRINCIPLE OF SYMPATHY. HUME.

1. *The Two-fold Hume; Method versus Material. The Individual as Egoistic or as Social.*

In Hume we have what is so often seen in a great thinker, the effort to make an inadequate principle cope with the material which his genius can but recognize. A born psychologist, seized by the brilliant idea of an 'attempt to introduce the experimental method of reasoning into moral subjects,' convinced that the true path of science lay in 'explaining all effects from the simplest and fewest causes,' he seeks to analyze human nature into its elements and discover the moving forces. For the intellectual life these prove to be impressions and ideas, acting according to laws of association or mental 'attraction.' In the moral life the chief phenomena to be explained were (1) the distinctions made in calling acts good or bad, virtuous or vicious; (2) the fact of social control or justice, and the closely connected fact of authority and duty; (3) the motor forces of the moral man, especially of the acts called benevolent. Into what simplest elements could all these be resolved? Impressions of pain or pleasure and corresponding ideas, or fainter copies, would naturally offer themselves as the ultimate atoms. Then good and evil = pleasure and pain; virtue = conduct associated with pleasure to the public, which in turn may become associated with my pleasure by arbitrary law of authority (Locke) or by habit and education (Mandeville). Justice = control of the individual in the interest of the majority, and therefore an arrangement for increasing ultimately my pleasure through furnishing security and protection for property. Duty or obligation = a constraining motive, *i. e.*, an impression or idea of pleasure or pain. Finally, desire = uneasiness caused by idea of pleasure not at present enjoyed, and benevolence = desire of a pleasure to be obtained by acts which produce enjoyment in others. Here was an analysis already provided in its main features by Hobbes, Locke, and Mandeville, and lending itself easily to Hume's principles of association. His main achievement in the working out of this analysis was his introduction of 'sympathy' as the machinery by which Hutcheson's moral sense might be reduced to more consistent psychological terms, and the social judgments and affections be given as subjective and individual an interpretation as the world of matter and force had found in the former part of the treatise. Sympathy does for the emotional life what custom does for the intellectual. It gives the vividness of feeling (*i. e.*, belief in the anticipated effect — pain at the suffering of another) to the mere image or idea — in the one case, the image of the expected consequent, in the other the image of pain. So far, Hume the analytical psychologist, to whom Green devoted his unsparing criticism.

But there is another Hume, the genial man of the world, whose powers of observation cannot be entirely controlled by the brilliant simplicity of his theory, and who is frequently introducing material which suggests or enforces a theory more adequate to the social forces of his day, even if he never rises to the height of a theory that could do justice to the sense of duty or to self-forgetting enthusiasm for the public weal. The latter Hume is more explicitly manifest in the *Enquiry* than in the *Treatise*, but the antithesis between method and subject-matter reveals itself frequently in the earlier work. We shall consider this antithesis in the account of good and virtue, of sympathy, of justice and of benevolence.

2. *The Conflict in the Account of Good and Virtue.*

Good and evil are other terms for pleasure and pain. This first reduction is easy. But 'good' means not merely (*a*) private good, my own present or anticipated pleasure, but also (*b*) public good. This social meaning had been recognized by the utilitarianism which had appeared in nearly all writers since Cumberland. Locke, Mandeville, Shaftesbury, Hutcheson and Gay, had recognized this as the primary import of 'moral' good or virtue. The problem lay in the transition from this public good to private pleasure. Locke had sought it through the identification by the individual of public happiness with his own advantage, and in part through the 'will and power of the lawmaker' in the enforcement of the law. Mandeville had effected the transition by the artifices of priests and politicians. Hutcheson had insisted on the public implication as too definitely disinterested to be capable of reduction to private pleasure by any hitherto recognized avenue, and evoked the faculty of the moral sense as a new susceptibility to pleasure or pain. Hume, on the one hand, accepts and even emphasizes the disinterested character of the moral judgment as such, while on the other, in obedience to his method, he seeks to reduce it to a form of pleasure and pain. Here comes the inevitable contradiction. Virtue presupposes a reference to the public. But the public good as such is merely an 'idea'; it is not an impression, and unless it can become an impression, *i. e.*, can be felt as well as perceived or imagined, it cannot be valued by *me*. It can neither stir my emotion nor kindle my desire, nor even be called 'good.'

To bring out this contradiction more in detail we note, first, the passages illustrating the public reference of all moral judgments. The very language of morals, Hume maintains, implies another than the individual standpoint. If one uses such epithets as "vicious or odious or depraved, he speaks another language and expresses sentiments, in which he expects all his audience are to concur with him. He must here, therefore, depart from his private and particular situation, and must choose a point of view common to him with others."[1] This social language in turn rests upon a social feeling. "'Tis only when a character is considered in general, without reference to our particular interest, that it causes such a feeling or sentiment as denominates it morally good or evil."[2] Here the necessity of the social standpoint is asserted. But it is not sufficient that a character 'be considered in general' in order that it may be pronounced good or bad. If the 'consideration' were merely intellectual or by the 'reason' we could assign no moral stamp. Reason might decide that the character in question was advantageous to the public, but that in itself would be a merely intellectual proposition — a relation between 'ideas.' Value must be *felt*, and the value which we call moral good must therefore be a feeling:

---

[1] *Enquiry*, Sec. IX., pt. I.

[2] *Treatise*, Bk. III., pt. I., sec. II.

"We do not infer a character to be virtuous because it pleases; but in feeling that it pleases after such a particular manner, we in effect feel that it is virtuous;" or, more emphatically still, "it lies in itself, not in the object. So that when you pronounce any action or character to be vicious, you mean nothing, but that from the constitution of your nature you have a feeling or sentiment of blame from the contemplation of it. Vice and virtue, therefore, may be compared to sounds, colors, heat and cold, which, according to modern Philosophy, are not qualities in objects but perceptions in mind."

The public reference has thus become merged in a feeling of pleasure. As a feeling it is *my* pleasure and not the public's. This is the price it must pay in being converted from an idea into an impression. But Hume seeks to save the public reference by the qualifying phrase 'pleases after such a particular manner.' If now we raise the old question of Socrates, can one pleasure differ from another except in the more or the less? we shall find Hume facing the following dilemma: moral distinctions are either merely a more or less intense pleasure or pain, or they require us to believe that they are part of a mental state which cannot be reduced to bare pleasure-pain quality. The first alternative contradicts the assertion of their disinterested public reference; the second implies a ground of preference between pleasures which is not itself pleasure-pain, and therefore is fatal to the reduction of the moral sentiment to bare feeling. Hume's method of meeting the dilemma is the assertion that there are different kinds of pleasures, and that the particular kind of pleasure of which we are in search here is the pleasure communicated through sympathy.

3. *The Conflict in the Account of Sympathy.*

The pleasure communicated *through* sympathy — not the pleasure *of* sympathy. These are two very different conceptions, for the antithesis in Hume's system appears strikingly in the double meaning of the term sympathy. In the *Treatise* it is not an emotion but a process. In the *Enquiry* it is sometimes a process but is also either an emotion or an impulse. Sympathy as a process or law of relation is parallel to processes of association or mental 'attraction.' It is conceived in equally mechanical terms, and the tendency of modern psychology is to find a physiological statement for both.

"The minds of all men are similar in their feelings and operations, nor can any one be actuated by any affection, of which all others are not, in some degree, susceptible. As in strings equally wound up, the motion of one communicates itself to the rest; so all the affections readily pass from one person to another, and become correspondent movements in every human creature."[1]

The more exact analogue of sympathy is 'custom,' for sympathy does for the emotional life what custom does for the intellectual. It gives the vividness of feeling to the mere image or 'idea.' "When we sympathize with the passions and sentiments of others, these movements appear at first in our minds as mere ideas, and are conceived to belong to another person. 'Tis also evident that the ideas of the affections of others are converted into the very impressions they represent."[2]

The process in question is that described by Spinoza as 'imitatio affectuum.' It is based on a physiological or psychological susceptibility to environing conditions, and evidently does not necessarily involve any regard for the welfare of others.

I may be pained by my neighbor's misery, if I am so unfortunate as to see it: but on Hume's theory there are two ways of relieving the pain. I may assist my neighbor, or I may turn my back and divert myself; and there is no reason, in Hume's psychology, why the latter would not be as effective as the former. The answer to the question, which way of relief I should follow, would depend on which were most convenient and expeditious. If to relieve the other's misery requires sacrifice of some other pleasure, while to turn my back requires no sacrifice, there is nothing in the imitation of emotions which calls for the former course.

---

[1] *Treatise*, Bk. III., pt. III., sec. I.

[2] *Treatise*, Bk. II., pt. I., sec. XI.

This 'sympathy' of the *Treatise* is undoubtedly a fact of social psychology. No one who has watched the mobile face of a child, as it responds to the play of emotions in the surrounding company, will question its value as affording a basis for intelligent and vivid appreciation of another's situation. The modern psychologist who regards the moral self as the product of social forces will find a distinct advance in the *Treatise* over the standpoint of Mandeville, who struck out this line of inquiry. Mandeville's Individual is composed as follows: (*a*) Self-interest; (*b*) susceptibility to the opinions of others through honor and shame. Hume's, in the *Treatise*, is composed of (*a*) self-interest; (*b*) susceptibility to the opinions of others through honor and shame, as with Mandeville; (*c*) psychological responsiveness to the emotional conditions of others. The social forces have thus an additional avenue of influence upon the Individual, and the Individual is not quite the bare abstraction of the earlier writer. But, granting all this, have we told the whole story of human nature when we have fitted out the Individual with the three capacities noted above? As a matter of fact, is man so indifferent to the welfare of others, except as passively experiencing pleasure and pain from their emotions, that he will as readily turn his back as reach out his hand? The demand for simplicity which was uppermost in the *Treatise* would lead toward considering the above analysis as adequate. Hume, the observer, decides otherwise in the *Enquiry*.

The *Enquiry*, to be sure, employs sympathy as a name for 'contagion' or imitation of emotions,[1] but it also employs the same term to denote a very different psychosis, viz., an impulse or even a desire. It is a 'concern for the interest of our species,' 'fainter than our concern for ourselves.' It is used as a synonym for 'benevolence' or 'humanity,' and these are one or all in various connections referred to as a 'propensity to the good to mankind,' a 'feeling for the happiness of mankind and a resentment of their misery.' The 'merit ascribed to the social virtues * * * arises chiefly from that regard which the natural sentiment of benevolence engages us to pay.' It is 'the benevolent principles of our frame,' the 'principles of humanity and sympathy' that engage us on the side of the social virtues. "Where is the difficulty in conceiving * * * that from the original frame of our temper we may feel a desire of another's happiness or good?"[1] Many of these expressions, especially if we were to view them in connection with the illustrations referred to above, might easily be regarded as due to an unconscious employment of the term sympathy in its more usual significance, where it almost invariably has a social and moral content; or perhaps they might even be considered as a device similar to that employed by Hume in explaining our belief in an external word, where he frankly announces that he will call the content of consciousness, '*object* or *perception* according as it shall seem best to suit my purpose,' since he is accounting for the 'opinions and belief of the vulgar.' So it might seem that Hume was here using sympathy now as an emotion, and now as an impluse or desire, and again as a process, in order to bring all the common phenomena of moral sympathy under the explanation of original or 'contagious' pleasure-pain. This appears to be Green's view when he says that in these passages (in which sympathy is opposed to self-love), "Advantage is taken of the ambiguity between 'emotion' and 'desire,' covered by the term 'passion.' That there are sympathetic *emotions* — pleasures occasioned by the pleasure of others — is no doubt as cardinal a point in Hume's system as that all *desire* is for pleasure to self."[2] But there are two grounds which speak for the view that another tendency in Hume's thought is here honestly forcing its way from mere incidental reference in the *Treatise* to a definitely maintained principle in the *Enquiry*, and in the face of the evidence it seems arbitrary to say a 'desire not founded on pleasure * * * was in too direct contradiction to the first principles of his theory to be acquiesced in.' Is it impossible to suppose that he had modified some of his 'first principles,' or, at least had come to maintain others which a later critic might see to be contradictory to those 'first' principles?[3]

---

[1] Especially the illustrations, pp. 208 ff. (Green and Grose.)

---

[1] Pp. 214 ff., 259, 271.

[2] Green, *Works*, I., 351.

[3] *Ibid.* Cf. however Green's note on same page.

The two grounds for this supposition are, first, the criticisms upon the tendency to undue simplifying,[1] and secondly, the polemic against the reduction of all impulses or desires to self-love. The first of these tendencies may well have been due to the wider reflection of the maturer man; the second seems to have been due to the influence of Butler, at least so far as its psychological form is concerned.

4. *The Conflict in the Account of Justice.*

Hume's analysis of justice presents the two tendencies of his thought in a peculiarly striking form. The discussion in the *Treatise* starts with the inquiry as to whether justice is a natural or an artificial virtue. From the standpoint of preceding discussions by Hobbes and Cumberland, this was equivalent to asking whether the sanctions of justice and its correlate, rights, were to be sought in the (egoistic) individual, or in a rational and social order of which the individual is inevitably a member. Hobbes consistently denied social control to his individual units and made rights = powers.[2] Shaftesbury, while not treating justice in detail, had sought to reassert the natural character of the 'love of justice,'[3] and had in general identified the 'just' with the 'right' as depending on 'equal' affections. Hume reiterates with Shaftesbury that the test of virtue must be in the affections or motives which prompt the acts, insists that love of justice is the only motive which can make an action just, and then inquires how 'justice' can have acquired such a value as to make it a motive. To Hume as analyst, value can mean only pleasure; the value of justice must be either its egoistic advantage, or its pleasure on the general view through sympathy. But an act performed for egoistic pleasure would not be just. On the other hand, an act performed solely to give pleasure on the general view would not give such a pleasure; it would be merely flattery; and therefore, since it would fail to gain its end, could not have the value of a 'virtue' (*i. e.*, of pleasing after a particular manner). What impulse can there be found in 'natural' man which would lead him to practice justice before society has come to value it? It is easy for Hume to show that neither private self-assertion nor emotional benevolence to individuals would result in justice, and "there is no such passion in human minds as the love of mankind, merely as such."

---

[1] *Essays*, Green and Grose ed., pp. 269–272.

[2] See *Univ. of Chicago Cont. to Phil.*, Vol. I., No. 5, pp. 19–21, 27.

[3] *Moralists*, Pt. III., Sect. 2

It is, therefore, not natural impulse, but a recognition of the value of society, for which justice is an indispensable foundation, that gives justice its value. Society creates the capacity for its appreciation; and society, in turn, though originally produced by sex and family impulses, is maintained because of its own value. Hume does not definitely discuss the impulse of resentment which Shaftesbury had alleged to imply a demand for justice. Hume might well have said, however, that while resentment does stand for defense against invasion upon an individual's personality or interests, it is only when the individual socializes his attitude that resentment becomes a demand for justice, and by hypothesis we are as yet considering man antecedent to society. Hume, the analyst, has thus made out his case that justice is an 'artificial,' not a 'natural virtue,' and therefore has apparently succeeded in applying his method to a fact which seems to resist stubbornly any resolution into units of pleasure, either private or sympathetic.

But there are frequent indications that Hume regards his labored analysis as itself an 'artificial' process. The rules of justice may be called 'Laws of Nature,' 'if by natural we understand what is common in any species, or even if we confine it to mean what is inseparable from the species,'[1] and the *Enquiry* holds that 'it seems vain to dispute whether justice is natural or not.' For, as already noted, the only means by which Hume could prove justice not to be a natural virtue was by showing that it was not to be found in man apart from society. He recognizes, however, that a state of nature prior to society is a 'mere philosophical fiction, which never had and never could have any reality.' It is merely a device for considering separately the two parts of human nature, viz., 'the affections and understanding.' In other words, Shaftesbury, as was pointed out, defined the ethical individual in terms of affections; Hume shows that at least one of the ethical virtues implies other elements.

---

[1] *Treatise*, III., II., I.

Recognition of the difficulty in resolving all regard for justice into terms of individual pleasure and pain is seen also in Hume's resort to the device of 'general rules.' The law has been previously laid down that 'our sense of duty (*i. e.*, our pleasure or pain) always follows the common and natural course of our passions.' These passions, in turn, whether of self-interest or of kindness, are always directed by particular motives. They would lead me to give an estate to my friend or to the poor; justice as often decides for my enemy, or for the rich. How is it that the ordinary rules of morality are here superseded? Because the 'natural' avidity or partiality of men would produce 'an infinite confusion in human society.' Hence, men 'have agreed to restrain themselves by general rules.' Agreement 'to restrain themselves by general rules' reminds us of Hobbes's contract by which men establish a sovereign who determines justice. It is no doubt a highly artificial method of explaining the transition from the self of merely particular impulses with corresponding 'obligations' (*i. e.*, pleasures and pains) to the social self who is a member of a whole, and therefore may claim 'rights' and recognize authority by virtue of his membership.[1] And yet it certainly is less completely external than Hobbes's account, and it does signify an effort to recognize a social whole which is greater than the sum of its parts. The happiness of mankind, 'raised by the social virtue of justice and its subdivisions,' may be compared to the building of a vault, where each individual stone would of itself fall to the ground; nor is the whole fabric supported but by the mutual assistance and combination of its corresponding parts.'[2]

'General rules' appear again in the explanation of the authority of government. If, as Hume has stated, political authority was established by a sort of convention to secure the individual interests of the subject, does its authority cease the instant it ceases to be of advantage to a given individual? In other matters we say: "The cause ceases; the effect must cease also." The 'natural obligation' to allegiance (*i. e.*, self-interest) does indeed cease when the advantage ceases, but the 'moral' obligation remains, because 'men are mightily addicted to general rules.'[1] Here a sort of moral inertia or custom is used to explain conduct at variance with a purely individualistic theory of authority.

---

[1] Hume admits the helplessness of the situation if a 'sensible knave' is shrewd enough to agree that honesty is the best policy as a general rule, and at the same time takes advantage of all the exceptions. *Enquiry*, Sec. IX., Pt. II,

[2] *Enquiry*, App. III.

Finally, we notice Hume's tendency to a less individualistic theory of justice and political authorities in the use of the terms 'public good' and 'public interest' in the *Treatise*, and in the more explicit declarations in the *Enquiry* that the foundation of justice is the 'well-being of mankind and the existence of society.' The terms themselves, 'public interest,' and the like, might conceivably mean merely the sum of the egoistic interests of the individuals who compose the public. The decisive and important questions are, whether the observance of justice is merely a means to private pleasure, or is itself a factor in well-being; whether society is merely an instrument for increasing private happiness, or is itself a good because of its enlarging and uplifting character; whether 'utility,' which is called the foundation for virtue, is to be measured in terms of pleasure and pain without regard to quality, or whether progress in intelligence, in humanity, and in regard to the good of the community is itself a desirable end.

In answer to these questions it must be admitted that Hume does insist that justice and society owe their origin to self-interest of an egoistic sort. He expressly states that although justice favors public interest, this very fact proves its artificial character, since men 'naturally' have no such regard. But, on the other hand, he recognizes that society adds a new content to human satisfaction. Men by their early education in society not only 'become sensible of the infinite advantages that result from it,' but 'have besides acquired a new affection to company and conversation.'[2] In the *Enquiry* he habitually uses language which implies that 'utility' is measured in social terms.

---

[1] *Treatise*, Bk. III., Pt. II., Sec. IX.

[2] *Treatise*, Bk. III., Pt. II., Sec. II.

Happiness and 'perfection' are dependent upon justice. 'Mutual trust and confidence,' 'the intercourse and social state of mankind,' are made its end.[1] 'What injures the community, without hurting any individual,'[2] is a phrase which certainly implies that the community interest is more than the mere algebraic sum of private interests. I conclude then that while we may not attribute to Hume any such conception of the dignity of personality secured only through justice as appears in later thought, it would be unfair to charge him with a purely individualistic conception of public interest and of justice.

5. *The Conflict in the Account of Benevolence.*

The dominant theory of desire in the *Treatise* is that 'the mind by an original instinct tends to unite itself with the good and avoid the evil,' and that good and evil are 'in other words pain and pleasure.'[3] "'Tis from the prospect of pain or pleasure that the aversion or propensity arises toward any object."[4] This is maintained as the decisive factor in the controversy over the claims of reason *versus* a moral sense. Reason can neither cause nor control actions. It 'is and ought only to be the slave of the passions.' The theory of obligation is stated consistently in terms of pleasure and pain: "When any action or quality of the mind pleases us *after a certain manner* we say it is virtuous; and when the neglect or non-performance of it, displeases us *after a like manner*, we say that we lie under an obligation to perform it." "It would be absurd, therefore, to will any new obligation, that is, any new sentiment of pain or pleasure."[5] The 'natural obligation' of allegiance to government is due to interest; the 'moral obligation' (*i. e.*, feeling of pain incurred), is due to sympathetic participation in the pleasure and pain of the public whose interest is subserved by government.[6] So too in the *Enquiry* he will consider our 'interested obligation' to virtue. It will appear that virtue "talks not of suffering and self-denial, * * * her sole purpose is to make her votaries and all mankind * * * cheerful and happy." Nor let any suppose that 'social' sentiments will interfere with 'selfish.' "It is requisite that there be an original propensity of some kind, in order to be a basis for self-love, by giving a relish to the objects of its pursuit; and none more fit for this purpose than benevolence or humanity."[1] All this speaks the language of a consistent hedonism bent on reducing the moral consciousness in all its phases to the simplicity of pleasure and pain.

---

[1] Sec. III., Pt. II.

[2] App. III.

[3] Bk. II., Pt. III., Sec. 9.

[4] *Ibid.* Sec. 3.

[5] Bk. III., Pt. II., Sec. 5.

[6] *Ibid.*, Sec. 8.

But side by side with the above theory runs another tendency to recognize other impulses than a desire for pleasure, and to regard the social impulses and sentiments as not merely catering to the enjoyment of a fixed self, capable only of egoistic pleasures and pains, but rather as so socializing and transforming the individual as to make him enjoy, not as private or exclusive, but as social and inclusive. Desire is held to be aroused not merely from pain and pleasure but also from 'a natural impulse or instinct, which is perfectly unaccountable'; and as such instincts are named 'benevolence, resentment, love of life, kindness to children, desire of happiness to our friends, fear, hunger, lust and a few other bodily appetites.'[2] "These passions, properly speaking, produce good and evil, and proceed not from them, like the other affections." In the appendix to the *Enquiry* the independent character of these instincts is further asserted and defended by substantially Hutcheson's argument. Another's good may, 'by means of that affection' (benevolence) become our own, and be afterward 'pursued from the combined motives of benevolence and self-enjoyments.' The important point is that the self which enjoys benevolent acts, even though these be of a merely impulsive sort, is potentially a moral Individual, and has a broader basis for future moral development than the Individual who responds merely to pleasure and pain. For this is a long step from the 'simplicity' of strict hedonism. It is a movement toward the recognition that the desirable end may be measured in other terms than merely its hedonic tone. It means the vague recognition of the difference between pleasure communicated by sympathy or 'contagion,' and pleasure or satisfaction due to the actual regard for my neighbor's welfare as such, even though it conflicts with my own.

---

[1] *Enquiry*, Sec. IX., Pt. 2.

[2] *Treatise*, Bk. II., Pt. III., Sec. 9, 3.

This same motive seems to underlie the phraseology already noticed, in which virtue is described as that which gives pleasure of a '*particular kind*' even though the emphasis seems to be on the 'pleasure' as the important factor, and the whole psychology of the individual seems on the verge of reconstruction in the attempt to understand the objective and general character of moral sentiments and judgments. Even as its stands the passage shows a better appreciation of the implications of a moral judgment than appears in the well-known passage of Mill's *Utilitarianism*. "Each person desires his own happiness, * * * each person's happiness is a good to that person, and the general happiness, therefore, a good to the aggregate of all persons."

SECTION IX.

THE INDIVIDUAL THE CREATION OF SOCIAL FORCES.

It is in Adam Smith that the social character of the entire moral life receives fullest recognition. It is not that he regards the individual as absorbed in the social welfare and forgetful of himself and his private interests. There is by no means so enthusiastic a view of the benevolent character of the individual as with Hutcheson, nor does Smith demonstrate so eloquently as Shaftesbury that man can be happy only in the exercise of his social affections. His theory of the moral sentiments is quite in line with his theory of political economy, in the view that self-interest is the strongest natural force, and he considers that it is well that this should be the case. "Every man is first and principally recommended to his own care. His own pleasures are the substance, those of others are the shadow."[1] He speaks of a 'feeble spark of benevolence which Nature has lighted up in the human heart';[2] and again remarks that

[1] *Moral Sents.*, Pt. VI., Sec. 2, Ch. 1.

[2] *Ibid.*, Pt. III., Ch. 3.

the selfish side is 'by no means the weak side of human nature.'[1]

It is his conviction that the welfare of the whole is best subserved by this constitution of human nature which directs our attention and affection first to ourselves, then to our immediate relatives and friends, and later on to our nation, and finally to mankind.[2] All this was a more faithful reflection of the individual life of man in this century of commercial relations than was the optimism of Shaftesbury, or the benevolent theory of Hutcheson. Smith's great achievement lay rather in the line of recognition that man's moral life is not the result of his individual impulses and natural affections, but is rather preëminently the outcome of the social forces which have played upon him through all past history and with increasing strength as the race has developed in the means of social intercourse.

It probably was not in his thought that the separation which he achieved in his *Wealth of Nations*, between the economic life of man and the other aspects of human experience, pointed toward just the distinction which he had achieved in his theory of moral sentiments; but there is, at any rate, an interesting parallel. For by isolating the conception of wealth and all human desires that relate properly to that end, Smith made it possible to see more clearly the difference between the economic values and motives on the one hand, and moral values and motives on the other. Now, in the *Moral Sentiments* he says very clearly that all the moral judgments and values are pronounced from a distinctly social standpoint. The interesting problems, therefore, in considering Smith's conception of the individual and society, will be discovered if we show in some detail his attempt to state the social character of the moral judgments; and in the next place, see how he aims to account for this social moral self.

1. *The Social Factor in the Moral Judgments.*

The three most important aspects of the moral consciousness which Smith considers are judgments (*a*) upon the propriety of actions; (*b*) upon the merit of action, and (*c*) upon our own conduct in the form of conscience.

[1] *Ibid.*, Pt. VII., Sec. 2, Ch. 3.

[2] *Ibid.*, Pt. VI., Sec. 2, Ch. 1.

As to the propriety of actions, this means the suitableness of the antecedent affections to the object proposed, or to the cause which excites; and we judge of the propriety of the acts of another by asking whether we could 'go along with the other' in his act. Could we feel as he feels, and could we act as he acts? If so, then we can sympathize with his sentiments, and in so doing we approve the act. As compared with the theory of his fellow-Scot, which we have just been considering, we note that this has a more striking emphasis upon the æsthetic element in our own judgments of moral conduct. It is not merely the question as to whether the act excites agreeable feelings in the agent or in others. We approve the act without any consideration of its consequences. We consider the motives and the appropriateness of the action in view of those motives, and if the act is one that we could 'go along with,' and therefore one which any one could 'go along with,' we approve it. The sense of propriety, therefore, is primarily a disinterested judgment by all spectators.

(*b*) With reference to the merit of acts, the same social standard is also on the surface and needs no detailed statement, for the merit of acts arises from our sympathy with the gratitude or the resentment of some one who is affected by the acts, and it is only as we can 'go along with' such gratitude or resentment that we can attach the sense of merit or demerit to human actions. Here again it is interesting to note that our sympathy is not merely with the passive feeling of the actor or of the persons affected, but it is rather with their active impulses, and the significance of this will be considered later on.

(*c*) It is in his statement of the social nature of conscience that Smith's reflections have the greatest interest. We have seen that, with the exception of Butler, British moralists of this century had particularly ignored the problems of conscience and duty, largely because these problems were not easy of answer in terms of an individualistic psychology. Hume gives an answer which practically eliminates entirely the element of authority from the sense of obligation and leaves this sense of duty as merely a competing force of self-interest. Smith, by recognizing the social nature of conscience, is enabled to give it a more conspicuous position, while nevertheless, he can explain it in terms of social psychology. For just as I approve the actions of others, so I must recognize that others are approving or disapproving my actions, and by identifying myself with the judging public I make myself as judge a social self, and therefore feel the authority of a judgment which transcends my private and particular impulses. In this full recognition of the social nature of conscience, Smith completes the account of the moral life in terms which allow him to recognize, instead of ignore, the most vital part of that life.

2. *The Rational Element in the Moral Individual.*

Smith introduces a rational element in the social self of the moral life, and thus aims to reach not merely a universal which is constituted by a number of concurring individuals, but one which is a true universal. This appears in each of the phases of the moral life which we have noted above.

In the first place, it is seen in our estimate of the propriety of actions; for Smith evidently does not intend to say that every act which we might sympathize with, or which, in some moods, we do sympathize with, is a proper act. It is an act which we, not merely as individuals, but as 'impartial spectators,' can sympathize with, that we approve as proper; and the supposed impartial spectator is not defined in a merely negative way, as the man who has no positive bias. He is the reasonable man; the man who can form a judgment of the relation between the end and the means, between the cause and the effect.

This rational element appears also in our judgments upon the merit of actions. This judgment is stated by Smith to be a compound judgment, depending indirectly upon our sympathy with the gratitude or resentment of the person acted upon, and directly upon our sympathy with the motive of the person who is acting. It is his emphasis upon this latter element, in Smith's own estimation, which distinguishes his system especially from that of Hume. Smith holds that our estimate of the utility of actions plays, on the whole, a relatively minor part in our judgments upon their moral value.

Now, as we have just seen, the element of propriety involves the rational relation, for a sense of harmony or discord, if we trace it to its æsthetic elements, involves much more than mere susceptibility to pleasure and pain. It involves pleasure and pain arising from the recognition of unity or lack of unity; and this in turn means that a self which can feel pleasure or pain because of unity or lack of unity, is a self which can express itself fully and easily only through unity. Therefore the æsthetic judgment of propriety, which Smith makes so fundamental in the moral consciousness, really pre-supposes a rational self which is seeking expression through these judgments.

This distinction between the actual public and the real social self appears most explicitly in the account of conscience, where the actual judgments of the public, 'the man without the breast,' are set off against the judgment of the true social self, 'the man within the breast.' Here we have made in explicit form the ambiguity which runs implicitly through the treatment of propriety and merit. Smith's statement is that the 'man within the breast' is the judge of what is praiseworthy, and praiseworthiness as distinguished from praise is defined as that character which is not merely approved by others, but which we should ourselves approve. The desire to be worthy of praise, therefore, means a desire that men should regard us in the same light as we should regard actions in others which we praise.

But if we take this statement of the case as complete, it is evident that we should simply revolve in a circle, without ever reaching any real distinction between the individual feeling expressed in praise or blame, and the universal moral approval which Smith is trying to distinguish. For if I can actually approve my own acts, and if approval means merely an emotional attitude, then it is evident that I do not raise this to any higher principle by my supposed reference to the judgment of the impartial spectator, since the only test which I am supposed to apply to his fairness is the fact that it evokes my emotional response. That is to say, if I judge myself by an impartial spectator, and then judge this impartial spectator by the same self, it is evident that I never get above my own level. I am simply adopting Baron Münchausen's method in the moral world, of lifting my emotions to a universal standpoint by the sole leverage of imagination. As if vaguely aware of this impossibility, Smith repeatedly uses, throughout this section, language which expresses an entirely different conception of the impartial spectator. Thus, our judgment bears some reference to what 'ought to be the judgment of others'; 'praiseworthiness and blameworthiness express what naturally ought to be the sentiments of other people'; 'nature has endowed man with a desire of having what ought to be approved of'; 'we dread the thought of doing anything which can render us the *just and proper* objects of the hatred and contempt of our fellow creatures.'

In several of these cases he gives as alternative language for 'what ought to be approved of,' 'or of having what he himself approves of in other men,' and apparently does not recognize the decisive difference in the two expressions. But it is perhaps in the conception of the 'all-seeing judge' that the inadequacy of the merely emotional justification of the sense of duty is best disclosed. This all-seeing judge 'whose eye can never be deceived and whose judgments can never be perverted'; who judges with 'unerring rectitude,' cannot possibly be translated to mean the judge whose decisions we in every case emotionally accord with. For this would be not only to eliminate any possibility of condemning ourselves by the standard of his justice. It would also prevent me from finding in him an independent reenforcement and support to my own supposedly rightful attitude. It is of course true enough that in the last analysis our conception of such a just judge must be drawn entirely from our own ideas, but Smith's imagery fails to account for the formation of an ideal which transcends the present emotion.

3. *Inadequacy of Sympathy as Socializing Agency.*

This brings us naturally to the consideration of the process by which Smith would explain the formation of the moral sentiments. This, as is well-known, is done by the agency of sympathy. The propriety of an act is measured by the consonance of the agent's feelings and motives with my own; the merit and demerit, by my sympathy with the emotions of those who are affected, as well as with the emotions of the actor; and finally, conscience, by my sympathy with those who judge my acts. It is evident, then, that that sympathy is expected to transform the individual to a social consciousness. The conception of sympathy with which Smith prefaces his account of the moral sentiments is very nearly that of Hume, in the *Treatise*. The chief difference seems to be that Smith lays more stress upon the act of imagination, by which I place myself in another's circumstances. 'It is by changing places in fancy with the sufferer that we come either to conceive or to be affected by what he feels.' It 'does not rise so much from the view of the passion as from that of the situation which excites it.'

With Hume, on the other hand, we saw that the tendency in the *Treatise* was to conceive it as a mere emotional reflex, produced by the sight of certain signs of emotion in others. Does this change in the conception, by which a greater stress is laid upon the imagination, indicate any material change in the principle of sympathy, which will fit it to become a genuinely social principle? Smith is very confident that he has made it such. The classic statement, which is, to be sure, rather negative than positive, rather defending sympathy from the charge of being a selfish principle than asserting it to be a distinctly social principle, is that in Part VII., sect. 3:

> "Sympathy, however, cannot in any sense be regarded as a selfish principle. When I sympathize with your sorrow or your indignation, it may be pretended, indeed, that my emotion is founded in self-love, because it arises from bringing your case home to myself, from putting myself in your situation, and thence conceiving what I should feel in the like circumstances. But though sympathy is very properly said to arise from an imaginary change of situations with the person principally concerned, yet this imaginary change is not supposed to happen to me in my own person and character, but in that of the person with whom I sympathize. When I condole with you for the loss of your only son, in order to enter into your grief I do not consider what I, a person of such a character and profession, should suffer if I had a son, and if that son was unfortunately to die; but I consider what I should suffer if I was really you, and I not only change circumstances with you, but I change persons and characters. My grief, therefore, is entirely upon your account, and not in the least upon my own. It is not, therefore, in the least selfish. How can that be regarded as a selfish passion which does not arise even from the imagination of anything that has befallen, or that relates to myself, in my own proper person and character, but which is entirely occupied about what relates to you."

Let us see, however, whether the identifying of myself with you, through an imaginary change of situations, really makes it necessary that my grief should be 'entirely upon your account.' It of course means that while I am by fancy playing your part, I play it with all the emotional concomitants. If I am to play Hamlet, I must mourn for my father; but does it by any means follow that Hamlet is really anything to me while I am myself? Suppose I am presiding at a banquet, at which my dearest enemy is present, and that I know him to be a man who suffers agonies if called upon to make a speech. I may, by imagination, transfer myself to his consciousness and picture all the agony of embarrassment and confusion and general disgust which will follow if he is called upon, but this may not prevent me in the least from proceeding to call upon him, and so far from filling me with remorse because of the vividness with which I have just pictured his dismay, it may even give a keener edge to my malicious joy in his discomfiture, as I proceed to put him to torture. Is, then, the principle of sympathy, as Smith describes it, a selfish principle? No; neither is it a social principle. It is merely an agency by which I may put myself in another's place, and thereby have the capacity for doing him greater service or greater injury, according to my purpose. It does not necessarily make me seek my neighbor's good. It merely makes it possible for me to do good more effectively, provided I have the will to do it.

The fundamental psychological inadequacy of the principle lies or is contained in the above quotation; for a genuine sympathy in the moral sense of the word, by which we must seek to relieve others' misfortunes and to increase their joys, involves a distinct recognition of these sorrows and joys as belonging to another. If, therefore, I merely transfer myself by imagination to the other's situation, I have lost the very essence of the sympathetic situation.

4. *How can the Individual become an 'Impartial Spectator'?*

The psychological inadequacy already noted is also implicit in Smith's account of such a social conception as that of an 'impartial spectator.'

The judgments as to the propriety of acts or sentiments in the case of others are of two classes. The first class embraces the judgments in which all observers are equally disinterested, *i. e.*, the intellectual and æsthetic judgments. Harmony here needs no especial explanation in Smith's opinion.[1] The more important class is that in which observer and observed are differently affected, such as those of misfortune or injury to one of the individuals. Approval by the observer must rest on sympathy, and this in turn must be founded on an imaginary change of situation. "The spectator must, first of all, endeavor as much as he can, to put himself in the situation of the other, and to bring home to himself every little circumstance of distress which can possibly occur to the sufferer. He must adopt the whole case of his companion with all its minutest incident."[2] Complete identity of feeling cannot be attained. "Mankind, though naturally sympathetic, never conceive, for what has befallen another, that degree of passion which naturally animates the person principally concerned." The person concerned must lower his passion 'to that pitch in which the spectators are capable of going along with him,' if he would be in harmony with those about him. Even after this adjustment, 'what they feel will always be in some respects, different from what he feels.' This difference between what they feel and what he feels is the difference between an impartial spectator and an interested actor or sufferer. To what is this difference due, what is the psychological basis of impartiality? The ground stated is the inability of the imagination to make the change in situation perfect. "That imaginary change of situation upon which their sympathy is founded is but momentary. The thought of their own safety, the thought that they themselves are not really the sufferers, continually intrudes itself upon them; and though it does not hinder them from conceiving a passion somewhat analogous to what is felt by the sufferer, hinders them from conceiving anything that approaches to the same degree of violence."[3] From this it would appear that the difference between agent and spectator were wholly quantitative.

---

[1] *Moral Sentiments*, Pt. I., Sec. I, Ch. 4.

[2] *Ibid.*

[3] *Mor. Sent.*, Pt. I., Sec. I., Ch. 4.

We see the inadequacy of such an account of the formation of an 'impartial spectator' if we consider that on this theory complete success in identification of the two situations, or of the imaginary transfer, would mean that spectator and agent would coincide, thence the spectator as such would vanish; there would be no moral judgment. This is but the necessary consequence of making the difference between agent and spectator a quantitative one. There is indeed one passage which affirms a qualitative difference,[1] but this difference is not analyzed and there is no reason to suppose that the distinction between an impartial spectator in the negative sense, and a fair or just judge in the positive sense of a genuinely social consciousness, ever stood out clearly enough to constitute a problem.

For in Smith, as in Hume's *Treatise*, we have an attempt to explain the facts of the moral life from individualistic units, although these units are conceived as capable of acting upon each other to a certain extent. Leaving out of account the phrases which hint at a more adequate view, the psychical units of Smith's theory are constituted by imagination, reason, feeling, and certain impulses of gratitude, resentment, and a 'feeble spark of benevolence.' These units, being similar in their processes and capable of changing situations by imagination, repeat less vividly the feelings of each other, and further act as mirrors in which each sees its own conduct reflected. The individual does not know the concept of a common, social good, which forms the end of his purpose, the object of his desire, the center of his hopes, enthusiasms and devotion. Nor is he conceived as a member of a group, whether of the clan of earlier society or of the multifarious groups of to-day, in which the group interests, group standards and group reactions are the constant pattern for imitation, the constant atmosphere, the constantly impressed authority, until the unconscious solidarity of primitive or child-life gives place gradually to the consciously individual interests and motives on the one hand, and to the conscious recognition of social standards and control on the other. It is in such a process that social judgments are formed; but it is no reason for surprise that Adam Smith did not reach an adequate conception of this process.

---

[1] "The secret consciousness that the change of situations, from which the sympathetic situation arises, is but imaginary, not only lowers it in degree, but, in some measure, varies it in kind and gives it quite a different modification." Pt. I., Sec. 1, Ch. 4.

5. *Smith as the Interpreter of His Age.*

Smith's account of the Individual's moral and social judgments, however, was more than the mere theory of a closet psychologist. It was in certain aspects a strikingly true interpretation of the actual judgments and the actual sympathies and motives of his time, even as Shaftesbury and Mandeville had reflected other aspects. For, as indicated at the outset, one prominent characteristic of the time was a great increase in general intelligence, and a greater degree of toleration in religion and of mutual understanding. Men did actually enter into their neighbors' situations and place themselves at their neighbors' point of view to a far greater degree than in the preceding centuries of religious and political partisanship. This was the basis of their greater kindliness. It might be a poor foundation for the sterner virtues demanded in times of war or persecution. It was a valuable stage in preparation for a broader and deeper patriotism and religion. The sympathies of such an age are not those born of a common devotion or of common interest. They are born rather of mutual understanding and quick emotional response. They soften grief and increase our pleasures, but cannot be relied upon to hold when subjected to the strains of danger or diverging interests.

The judgments of an age of intellectual enlightenment and economic forces are likewise reflected in Smith's account. There is in such relations a frank recognition of egoistic aims and motives. In so far, each understands his neighbor and can 'go along with him.' Egoistic aims are as much the basis of trade as social or collective aims are the basis of the institutions dominant in the earlier ethical situation. But the economic or egoistic aims are limited in organized commerce by the desire to make the exchange, and the implied recognition that the bargain cannot be too one-sided. If one of the parties goes beyond a certain degree of cupidity the other will fail to 'go along with' him. The difference between the sentiments of the 'person particularly concerned' and that of the 'impartial spectator' is in this case, as Smith has described it, really a difference of degree. I do not expect or desire my customer or competitor to seek my interest; I merely cannot approve or 'go along with' him when he is egoistic beyond a certain point. The 'impartiality' of the spectator, as compared with the person principally concerned, may be of a similarly quantitative character in certain other cases, but the term 'impartial' suggests immediately the judge of conflicting economic interests, rather than the ideal of higher achievement or of larger social life and purer motive. The phrases 'praiseworthiness,' 'ought to be approved,' and others, already noticed, call indeed for a different ideal. They require for explanation a recognition of dualism in the self — whether this be defined as dualism between the intelligible and empirical, between rational self and self of desires, between egoistic and social, or between functional and structural; and this dualism had been temporarily lost from view in the absorbing empirical interests of the age.

The ethical theory of the eighteenth century has presented a view of the individual which reflects the economic and intellectual life of the age. Starting with thoroughly individualistic conceptions, measuring value in terms of feeling, conceiving reason largely as a mere means for obtaining the goods of feeling, and regarding desire and will as determined by feelings already experienced rather than by ideals of action, it never completely transcends these limitations. Nevertheless the conception expands to include new and more generous impulses. The abstractness of the older intellectualism is brought clearly into view; the dangers of the analytic method are in a measure recognized; the rational factor is introduced as an internal principle of control; the social forces are given an increasing recognition as the agencies which create and foster the moral life. The way is open for a system which will be enabled to assume the social good as the criterion and end of action, and rely on the social and immanent forces to make the social weal the motive to action.

The Psychological Review

EDITED BY

J. MARK BALDWIN
JOHNS HOPKINS UNIVERSITY

AND

HOWARD C. WARREN
PRINCETON UNIVERSITY

CHARLES H. JUDD, YALE UNIVERSITY (*Editor of the Monograph Series*).

WITH THE CO-OPERATION OF

A. C. ARMSTRONG, WESLEYAN UNIVERSITY, MIDDLETOWN, CONN.; ALFRED BINET, ECOLE DES HAUTES-ÉTUDES, PARIS; W. L. BRYAN, INDIANA UNIVERSITY, BLOOMINGTON, IND.; WILLIAM CALDWELL, McGILL UNIVERSITY; MARY W. CALKINS, WELLESLEY COLLEGE, WELLESLEY, MASS.; JOHN DEWEY, J. R. ANGELL, UNIVERSITY OF CHICAGO; C. LADD FRANKLIN, BALTIMORE; H. N. GARDINER, SMITH COLLEGE, NORTHAMPTON, MASS.; G. H. HOWISON, UNIVERSITY OF CALIFORNIA; P. JANET, COLLÈGE DE FRANCE; JOSEPH J. JASTROW, UNIVERSITY OF WISCONSIN; ADOLF MEYER, N. Y. PATHOL. INSTITUTE, WARD'S ISLAND, N. Y.; C. LLOYD MORGAN, UNIVERSITY COLLEGE, BRISTOL; HUGO MÜNSTERBERG, HARVARD UNIVERSITY; E. A. PACE, CATHOLIC UNIVERSITY, WASHINGTON; G. T. W. PATRICK, UNIVERSITY OF IOWA, IOWA CITY, IOWA; CARL STUMPF, UNIVERSITY, BERLIN; R. M. WENLEY, UNIVERSITY OF MICHIGAN, ANN ARBOR, MICH, and a special board for the PSYCHOLOGICAL BULLETIN.

THE PSYCHOLOGICAL REVIEW, New Series, is issued in two sections; the Article Section, containing original contributions, appears bimonthly, on the first of January, March, May, July, September, and November, the six numbers comprising a volume of at least 400 pages; the Literary Section (*Psychological Bulletin*) containing critical reviews, notices of books and articles, psychological news and notes, university notices, announcements, and shorter discussions, appears on the fifteenth of each month, and forms a separate volume of at least 300 pages.

Annual Subscription to Both Sections, $4.00 (Postal Union, $4.30); Bulletin alone, $2.00 (Postal Union, $2.20); Single Numbers of Article Section, 50c. (53c.); of Bulletin, 25c. (27c.).

In connection with THE REVIEW there is published annually

THE PSYCHOLOGICAL INDEX

a bibliography of books, monographs, and articles upon psychological and cognate topics that have appeared during the year. The *Index* is issued in March, and may be subscribed for in connection with THE REVIEW, or purchased separately. (*Index* and REVIEW, $4.50 per annum; Postal Union, $4.85. *Index* alone, 75 cents; Postal Union, 80 cents.)

In connection with THE REVIEW there is also published a series of

MONOGRAPH SUPPLEMENTS

consisting of longer researches or treatises which it is important to publish promptly and as units. The *Monographs* appear at irregular intervals and are gathered into volumes of about 500 pages, with a uniform subscription of $4.00 (Postal Union, $4.30). The price of single numbers varies according to the size. Five volumes have already been issued.

Subscriptions, orders, and business communications may be sent direct to Professor H. C. WARREN, Businesss Manager, Princeton, New Jersey, U. S. A., or forwarded through the publishers or agent.

PUBLISHED BY

THE MACMILLAN COMPANY,
41 N. QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK
AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St., W. C.);
LEIPZIG (Hospital St., 10); PARIS (76 rue de Rennes).

The Psychological Review,

MONOGRAPH SERIES.

The following *Monographs* have already appeared:

Vol. I.

1. ***On Sensations from Pressure and Impact**: HAROLD GRIFFING. Pp. 88. 75 cents
2. **Association**: MARY WHITON CALKINS. Pp. vii+56. 50 cents.
3. ***Mental Development of a Child**: KATHLEEN MOORE. Pp. iv+150. $1.25.
4. **A Study of Kant's Psychology**: EDWARD FRANKLIN BUCHNER. Pp. viii+208. $1.50

Vol. II.

5. **Problems in the Psychology of Reading**: J. O. QUANTZ. Pp. iv+51. 50 cents.
6. **The Fluctuation of Attention**: JOHN PERHAM HYLAN. Pp. ii+78. 75 cents.
7. ***Mental Imagery**: WILFRID LAY. Pp. ii+59. 50 cents.
8. **Animal Intelligence**: EDWARD L. THORNDIKE. Pp. ii+109. $1.00.
9. **The Emotion of Joy**: GEORGE VAN NESS DEARBORN. Pp. ii+70. 75 cents.
10. **Conduct and the Weather**: EDWIN G. DEXTER. Pp. viii+105. $1.00.

Vol. III.

11. **On Inhibition**: B. B. BREESE. Pp. iv+65. 75 cents.
12. **On After-images**: SHEPHERD IVORY FRANZ. Pp. iv+61. 75 cents.
13. ***The Accuracy of Voluntary Movement**: R. S. WOODWORTH. Pp. vi+114. $1.00.
14. **A Study of Lapses**: H. HEATH BAWDEN. Pp. iv+122. $1.00.
15. **The Mental Life of the Monkeys**: E. L. THORNDIKE. Pp. iv+57. 50 cents.
16. **The Correlation of Mental and Physical Tests**: C. WISSLER. Pp. iv+62. 50 cents.

Vol. IV.

17. **Harvard Psychological Studies, Vol. I.**; containing sixteen experimental investigations from the Harvard Psychological Laboratory: Edited by HUGO MÜNSTERBERG. Pp. viii + 654. $4.00.

Vol. V.

18. **Sociality and Sympathy**: J. W. L. JONES. Pp. iv+91. 75 cents.
19. **The Practice Curve**: J. H. BAIR. Pp. 70. 75 cents.
20. **The Psychology of Expectation**: CLARA M. HITCHCOCK. Pp. iv + 78. 75 cents.
21. **Motor, Visual and Applied Rhythms**: J. B. MINER. Pp. iv + 106. $1.00.
22. **The Perception of Number**: J. F. MESSENGER. Pp. iv + 44. 50 cents.
23. **A Study of Memory for Connected Trains of Thought**: E. N. HENDERSON. Pp. iv + 94. 75 cents.

Vol. VI. (To contain about 500 pages.)

24. **A Study in Reaction Time and Movement**: T. V. MOORE. Pp. iv+86. 75 cents.
25. **The Individual and his Relation to Society**: J. H. TUFTS. Pp. iv+58. 50 cents.

* Monographs so marked are not sold separately.

Vol. VI
No. 3

Monograph Supplements

October, 1904
Whole No. 26

THE

Psychological Review

EDITED BY

J. MARK BALDWIN
JOHNS HOPKINS UNIVERSITY

HOWARD C. WARREN
PRINCETON UNIVERSITY

AND

CHARLES H. JUDD
YALE UNIVERSITY
(*Editor of the Monograph Series*)

Time and Reality

BY

JOHN E. BOODIN, PH.D.
Professor of Philosophy, University of Kansas

THE MACMILLAN COMPANY,
41 NORTH QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK.
AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St. W.C.);
LEIPZIG (Hospital St., 10); PARIS (76 rue de Rennes).

PREFACE.

While the question of priority is not likely to be raised in regard to the central conception of this essay, it may be well to say a word about its genesis and historic setting. While I had previously had empirical leanings, it was the Harvard period, from 1897–1900, which brought to full consciousness my standpoint with reference to the fundamental concepts touched upon in this paper, especially that of time. This was not so much on account of the thinking going on in this direction, as because of the stimulating thought atmosphere and the generous recognition of any productive effort, however different and however critical of their own thought, on the part of such philosophers as James, Royce, Münsterberg, Palmer and the late Dean Everett. We developed our own meaning by wrestling with those thinkers, not by imitating them. The mere imitator was always held in contempt.

My own time concept came to clear consciousness first during the year of 1897. Through a closer study of Hegel, and especially through the reading of Royce's profound statement of idealism in his supplementary essay in his 'Conception of God,' I was strongly impressed with the inadequacy of the position of absolute idealism to meet the demands of experience. My reflections that year culminated in a paper read before Royce's Hegel Seminary in the spring of 1898. In this paper I stated the substance of the position here advanced. This paper was worked over next year and presented as my doctor's thesis in the spring of 1899. While I hope that my present statement is clearer and completer, I have seen no reason to change my main position. My conception of time was known at Harvard as 'the creeping in' concept, as I emphasized, instead of the serial character of time, the fact that it creeps into all our calculations and makes all our systems of truth unstable.

While the above will indicate somewhat what I owe to Professor Royce's generous criticism and coöperation, I feel that perhaps I owe even more to the sympathy and friendship of Professor James, as well as his brilliant suggestiveness. While I knew little about his metaphysical theory in formulating the outline of my own position and never had any metaphysical course under him, yet I lived in the same world with him, and have enjoyed ever since the inspiration of his encouragement and his faith in my poor efforts. Without this faith I should not have been able to do what little I have done. If this little work were worthy of being dedicated to so great a thinker, I should dedicate it to him.

What I owe to the appreciation and suggestions of the other teachers in the distinguished group I mentioned above is too subtle to state, and I only appreciate it more as time goes on. Perhaps the greatest help of all was their generous faith that I had something to say. I hope the future may bear them out in this, if the present does not. To the fine philosophic enthusiasm and fairness of Professor James Seth, especially in his Hegel Seminary at Brown, in the year 1895–1896, I also feel that I owe a great deal. To the great immortals of all ages, who have handed down to us the torch of truth, I hope the following pages will vaguely hint my indebtedness.

For the encouragement of the reader, who may get tired of the somewhat technical discussion of the first two chapters, I want to say that, should he have the patience to go on, he will find the later chapters more concrete. It seemed best, however, to develop first the logical definition of the central concept, as the metaphysical position largely hinges on this. I have tried, however, in order not to tax the memory of the reader too much, to make each chapter, dealing as it does with a special phase of the problem, a unit. While the style is not all that could be desired, I think that the reader who has the courage to read the paper through, will get a rather clear and definite idea of my main position, and that in the end perhaps should be the test. Hoping that this paper may help along the present discussion and may be prophetic of something better on my part and still more on the part of others, I venture to throw out these fragmentary hints.

I had hoped to see this essay in print during my connection with Iowa College, Grinnell, where I held the chair of philosophy, 1900–1904. But as that aim, owing to the vicissitudes of publishing, was not realized at that time, I want to express at least my appreciation of the scholarly and helpful spirit of that noble institution, which did not allow me to lose sight of my purpose. I also want to thank my present colleague, Dean Templin, for reading the proof as well as valuable advice.

THE UNIVERSITY OF KANSAS,
Lawrence, 1904.

CONTENTS.

CHAPTER I.

THE NATURE OF TIME.......... 5

CHAPTER II.

TIME DEFINED IN RELATION TO SOME OTHER CONCEPTS: 29
- (*a*) Time and Space.......... 29
- (*b*) Time and Irreversibility.......... 31
- (*c*) Time and Number.......... 32
- (*d*) Time and the Infinite.......... 38
- (*e*) Time and the Continuum.......... 42
- (*f*) Time and Causality.......... 48
- (*g*) Time, Chance and Necessity.......... 53

CHAPTER III.

TIME AND BEING — A SURVEY OF ATTITUDES.......... 60

CHAPTER IV.

TRUTH AND PROCESS.......... 81

CHAPTER V.

THE PROBLEMATIC.......... 95

CHAPTER VI.

TIME AND NON-BEING.......... 109

CHAPTER I.

THE NATURE OF TIME.

Let us go at once to the heart of our subject. What sort of a concept is time? To follow a somewhat antiquated terminology: Is time a formal or material concept? Or to be more modern, perhaps, is time a purely ideal construction or must it be considered also as a character of reality?

It has been the fashion in modern philosophy to go back to Kant in the discussion of almost every epistemological problem. This has of course its historical justification. For the understanding of the problems of philosophy, however, Kant is often valuable for enabling us to see things out of focus. So much did he throw things out of focus that it will take philosophy a long time yet to see some problems in their proper bearings. In fact, that in Kant which has been historically most influential is often that which is most arbitrary.

A. Time as a Form of Perception. (*Anschauungsform.*)

This is the case with Kant's fantastic definition of time and space as forms of perception (reine Forme der sinnlichen Anschauung) or, to use the even more imaginative mode of expression of Schopenhauer, 'the veil we throw over things.' Such crudities are interesting from the standpoint of logic chiefly because they lead us back to the beginnings of conceptual definition. Kant's utter disregard of genesis reminds one of Schopenhauer's irony as regards Jacobi that he took everything for *a priori* which he had learned before he was twelve years old, only that the period would have to be extended and the class enlarged so as to include Schopenhauer himself.

Wundt has pointed out in an interesting way that to each one of Kant's three main theses, in his metaphysical deduction, an antithesis can be stated.

“ Kant sagt :	“ Darauf lässt sich antworten :
(1) Das Zugleichsein oder Aufeinanderfolgen würde nicht in die Wahrnehmung kommen, wenn die Vorstellung der Zeit nicht a priori zu Grunde läge.	(1) Die Vorstellung der Zeit würde niemals entstehen können, wenn nicht ein ihr entsprechende Ordnung in der Wahrnehmung gegeben wäre.
(2) Man kann, in Ansehung der Erscheinungen, die Zeit nicht aufheben, während man ganz wohl die Erscheinungen aus der Zeit wegnehmen kann.	(2) Man kann die Zeit nicht ohne Erscheinungen denken, während man ganz wohl bei einer Erscheinung von der Zeit abstrahiren kann (insofern man z. B. bloss ihre qualitative und räumliche Beschaffenheit in Rücksicht zieht.)
(3) Die Axiome, dass die Zeit nur *eine* Dimension hat und verscidene Zeiten nur nach einander sind, können nicht aus der Erfahrung gezogen sein, weil sie apodiktische Gewissheit besitzen.”	(3) Die Axiome der Zeit können *nur* aus der innern Erfahrung gezogen sein, weil sie abgesehen von der Aufeinanderfolge unserer Vorstellungen völlig gegenstandslos sind, indem in einer leeren Zeit weder ein Verlauf noch eine Aufeinanderfolge stattfindet.”[1]

The difficulty with Kant is that he fails to distinguish between the formal aspect of time and the content of time. Time, however, is *a priori* only in the sense that any concept is *a priori*. It is a form or presupposition of perception in the sense any concept is, though being involved in all concrete experience, bound up as it is with the perceiving subject as well as the perceived object, it has a peculiarly fundamental place among our concepts. Kant rightly pointed out—and this is his everlasting service to philosophy—that the mass of sensations cannot as such present us with universals. For us subjective construction must come prior to the objective universal. As our acts can only become fruitful or successful, however, in so far as they are based upon proper anticipation of the character of the object, the concept cannot remain a mere *a priori* or subjective construction, but must be tested with reference to further behavior; the only purely *a priori* concept is the totally false one, the one that is mere subjective construction and meets with no response on the part of reality as perception and action.

Is there no truth at all, then, in the grotesque Kantian position? Yes, there surely is; and even its naïveté may make it all the more suggestive. Kant was right in holding that in order to perceive succession we must be capable of retaining in some way the past in the present. The moments of the succession must in some way be apprehended at once by the subject. But it is obvious also that in the sense in which the moments are apprehended at once or as coexisting, they are no longer successive; and hence the Kantian time-form so far from explaining the possibility of perceiving succession makes any such perception impossible. In his space metaphor of one dimension, on which his fourth and fifth theses are really based, Kant has lost sight entirely of the character of succession and emphasizes merely the simultaneity or timelessness of the time-form. So little did Kant differentiate time from space that it is obviously coexistence rather than succession that he has in mind in his statement of the axioms. Since the arising of the spatial series and the continuum of space, as we shall see later, must be explained with reference to time, it is obviously begging the question to make time simply a dimension of space.

---

[1] Wundt, Logik, Vol. 1, 2d Ed., p. 482.

The real antinomy which confronts Kant and Wundt alike is: *How can a timeless form take account of a real succession?* Wundt's antitheses maintain that there must be some correspondence between the time form and the perceived succession. But just what correspondence can there be between the simultaneity of coexistent order and the *nach einander* of empirical succession, where the existence of one fact excludes the existence of another? In the order 1, 2, 3, 4, etc., the members are equally present, but in counting or beating off 1, 2, 3, 4, etc., when one member is perceptually present, the others are not present in the same manner. But if coexistence and succession are antithetical kinds of fact, how can a timeless or *a priori* order correspond to a real succession? While Wundt is right in pointing out that time must depend upon experience for its character, he has entirely failed to show what this character must be. In attempting to find a correspondence between the *a priori* form and empirical succession he has only shown the utter untenability and absurdity of the Kantian position.

What deters the Kantians from any attempt at a logical analysis of time and makes them put it into a class by itself, or at most with space, is its fundamental character. It is involved somehow in all our experience. It is presupposed in all our conceptualizing. The whole world of significance presupposes it, hence how can we presume to understand it, *i. e.*, conceptualize it? Still, is not this very fundamentalness of time part of its significance? Because it is so intimately interwoven with our conceptual fabric, it is indeed difficult to extricate it and show its fundamental character; but it becomes all the more necessary to do so in order to have a valid theory of experience. It is indeed a crucial concept, as Kant saw, of any theory of reality.

Apart then from the mysticism of philosophy in the past, we must treat time as a concept, try to find what sort of a concept it is and try to seize upon its ultimate character, its ultimate significance, even though this should be involved in all significance. If the time character must be such as to enable us to explain succession, we must at any rate be careful not to define it in such a manner as to make succession absurd. The time and space veil we are supposed to throw over reality is at any rate a conceptual veil, an ideal system, the basis for the genesis of which must be found in the real, and the truth of which must be tested with reference to the behavior of the real. As all concepts have a formal aspect, involve ideal construction, our inquiry is, what sort of content or meaning time must have for us in order to make experience consistent.

B. Time as a Formal Concept or Ideal Construction.

Let us take up first the attempt to define time as our ideal construction and see what this leads to. This is already implied by Kant in his *Anschauungsform.* Wundt asserts that time is not so much a representation as an order of all our representations. It is this order character which has been emphasized by modern logic. Time has been regarded as primarily a series. Sometimes the qualitative, sometimes the quantitative character of this series has been emphasized, according as the idea of order or the idea of measurement has been uppermost. We shall take up first the definition of time as a qualitative series.

1. *Time as a Qualitative Series or Order Concept.* — Two

things are evidently involved in defining a qualitative series: position and direction or the constituting of order. Let us first deal with the aspect of position. Fortunately we have a rather clear statement on this point by modern thinkers. It is held by Münsterberg, Mach, and Teichmüller,[1] for example, that there are time qualities, just as there are qualities of sound, light, and touch, and these time-qualities serve to indicate position in a time-series, just as space-qualities indicate position in a space-series. Not only do the particular contents according to Münsterberg, have unique time-qualities, but the different time-series or time-wholes and their parts also have special time-qualities.

The time-series, then, furnishes us with a perspective, where different time-values are indicated by different qualitative positions. Each individual has of course his own perspective, which constitutes his own individual history, but by means of social communication we agree upon a common perspective, which shall be the same for all of us; and this is what we mean by objective time. Time is universal, according to Teichmüller, in the sense that any concept is universal: abstracted from its empirical data it becomes insatiable and can include any possible data or an infinity of data. As it is moreover the perspective or series in which all facts must be ordered, it may well be called the form of the inner life. But let us now turn to the critical examination of this theory.

(*a*) Dependence of the Qualitative View upon Quantitative Considerations.

Simple as the above statement appears, there are, nevertheless, some grave difficulties. Let us first try to understand what is meant by these time-qualities, which are to indicate position in our time series. Each immediate content of experience has indeed its duration character; and it is this discrimination of different duration qualities of contents which furnishes the ultimate basis for quantitative measurement. But this subjective comparison of the duration character of contents is available only within the very narrow limits of immediate experience. The equality of certain rhythms or pendulum movements can indeed be measured that way. It is difficult, however, to see what duration quality can mean beyond the cumulative significance of immediate perception. I can not understand what the duration quality of a minute can mean; still less of an hour, a day, a year, a century, etc. What has duration quality to do with my placing the siege of Troy and the siege of Yorktown in a series continuous with my own experience? Does not the dating of these events depend entirely upon quantitative symbols? In fact, it is only in so far as we refer our experience to certain quantitative standards that we can have anything like social agreement or an objective perspective.

---

[1] H. Münsterberg, *Grundzüge der Psychologie*, Leipzig, 1900, pp. 231–259. (See conclusion of this chapter for a bibliography.)

E. Mach, *Beiträge zur Analyze der Empfindungen*, Jena, 1886, essay on *Die Zeitempfindung*, p. 103 ff. (translated, Open Court, 1897); Teichmüller, *Die Wirkliche und die Scheinbare Welt*, pp. 188–243.

Moreover the duration quality of experiences as perception and as reproduced is very different. It is true, at least for larger intervals, that if relatively empty and void of interest they seem longer in passing than if full and interesting, whereas the opposite is true in recall. The sense of duration in the recall of the events of a life-time has very little to do with the sense of duration in living the events of a life-time. But, if duration quality is such a variable value as this, it can help us very little in dating. Our perspective, whether individual or social, depends upon referring our fleeting subjective experiences to certain quantitative standards. Our concept of a thousand years *means* indeed all the tingling duration values of living a thousand years; but it is in no sense a living over again of a thousand years (which we have not lived). The past duration values are not there now to tingle or supply the sense of position; and the reproducing of the experiences in a series would not mean a living over, but an entirely new set of duration values. Qualitative immediacy does indeed furnish the data for our ideal construction. Without our immediate experience of duration a century could not indeed mean a true experience to us. But the construction of a historic perspective, and dating within it, depend upon associating our experiences with quantitative processes. In discriminating qualitative time wholes and fractions of time, as Münsterberg does, we already presuppose both the concept of time and of quantity. Yes, even in the comparison of durations we are already in the realm of quantity.

Degrees of vividness have often been made the criterion of position in the time series. Within our own individual perspective this has a certain amount of truth. But remoteness or nearness in time is not the only factor which determines quality of vividness in recall. This depends besides upon the strength of the nervous discharge at the time of the occurrence, interest or coherency in a system, repetition, etc. Thus, even within our own history, events of years ago may be more vivid than those of yesterday. And of course outside our own perspective the vividness of our recalled content can be no criterion. What has the vividness of the siege of Troy to do with its time position in history?

(*b*) Conceptual Analysis of Duration Quality. Its Dual Character.

So important, however, is this quality or sense of duration of mental contents for the conception of time that such a deep and acute thinker as Shadworth Hodgson defines time as the 'duration of process.'[1] The quality of duration or transition of mental states is indeed the perceptual datum without which the time concept would be impossible. But whereas for perception this datum is simple, for conceptual analysis it is not so. Obviously in this perception of duration is involved a fleeting character and a habit character. When we say duration, we emphasize the positive character, *i. e.*, the persistent or cumulative character; when on the other hand we say fleetingness, we emphasize the negative or passing character. Each character is limited by the other. The character Professor James likes to emphasize and has made prominent in psychology is the on-the-wing character of experience; our mental life is in constant flux; it is not so much a substance as a stream. But obviously if this character of vanishing were absolute, mental life could not begin to be. It is because the perceptual contents persist for an appreciable time that we can have that immediate cumulative significance which makes a sense of real, living, warm transition possible.

---

[1] Shadworth Hodgson, *Metaphysic of Experience*, Vol. I., pp. 136 and 137.

This relative persistence of our perceptual contents, therefore, already points to the limiting of the negative character of the world by a positive or habit character, which makes such a thing as significance possible. Of course a purely negative world is not even conceivable. It would be unmade in the making and so could never begin to be. On the other hand the habit or duration character is equally limited; and it is because of this negation or transformation of our mental states into ever new ones that the music and continuity of mental life are made possible. In fact a world without transitions, of mere static particulars, is as inconceivable a world as that of pure negation without a habit back-ground to work upon. We not only cannot conceive of thought in a transitionless, particular world, we cannot conceive such a world to be except as itself an abstraction of thought. Transition or continuity in a purely positive or static world is inconceivable.

To be accurate in our terminology, then, we should say that our simplest perceptual datum is relative duration or relative fleetingness of mental contents. The qualification of relative, of course, is not as such *given*. This involves a conceptualizing or interpreting of our experience. It is only indeed on account of the relative stability of the conceptual system, the *Apperceptionsmasse* or the interpreting subject, that we can perceive duration or fleetingness. Were our total experience in equal flux this would make the perception and conception of flux impossible, though it would not necessarily do away with the reality of flux. Again the relativity of the conceptual system can be recognized in contrasting one system with another. The systems involving social and physical processes afford a measure for our more relative private interpretations. Thus different rates of duration and change make possible the perception of duration and change upon which our time-concept is based.

Since duration quality, therefore, involves this dual character of fleetingness and habit, which character shall we identify with time? Is not the persistence or presence of qualities for discrimination and comparison an essentially timeless affair, a defiance of time, a *nach einander* of simultaneity or space, whether ideal or perceptual? Is not a transformation of values, a coming and going, a transition of contents, a making past of the present, etc., the essential character of time? It is not the persistence of the intervals or moments of the face of the watch in one glance, that we identify with time, but the continuous succession or fleetingness of values. Hence the *fleetingness of process*, not 'the duration of process,' furnishes us with the real time content. Time is indeed involved as a character in our perceptual experience; but it neither is nor could be perceived simply.

What has given rise to the confusion as regards the time character involved in perception is that the perception of time is only possible because of relative constancy, as we have already seen. For our measurement of process the constant character of experience is indeed indispensable, but the measurement or quantification of process is, as we shall see later, an essentially timeless affair, is based upon a certain constitution of the now.

(*c*) The Qualitative View of Time fails to give us a Continuum of Experience.

If time again is a qualitative series, how are we going to account for the continuum of experience? The qualitative experiences are as such essentially discrete and finite. But even an infinite number of discrete qualitative positions could not give us a time continuum. If the continuum of time, therefore, is to keep our discrete qualitative experiences from falling asunder, we cannot account for time as a qualitative series. Nor can we take refuge in the device of the mathematicians in regard to the number series. For entirely apart from the possibility of deriving a continuum through introducing the irrationals into the number series, we have here to do with the *existence* of qualities, not with mere hypothetical description; and the perceivable qualities are finite and discrete, when abstracted from the time process in which they emerge.

Moreover, if the *esse* of time is *percipi*, then, in the absence of qualitative discrimination, time would also vanish, and we should have intermittent time-gaps corresponding to our own lack of consciousness of qualitative difference. This, of course, during our waking life, is a relative matter; but in the degree in which we lose ourselves in the present events and active reproduction ceases, does consciousness of duration tend to vanish. In dreamless sleep and in swoons time would vanish with our discrimination. Hence here we should have to speak of time-gaps.

But we have no sooner stated the position than the absurdity appears. As we determine the gaps in our conscious experience with reference to the time process, it is obviously begging the question to speak of gaps in time with reference to our experience. Our consciousness of process, while it is all important for the value of process, does not constitute the reality of process. The time-process, like the widely advertised cathartic pills, works while you sleep. The going on of process, moreover, during the cessation of conscious activity, is by no means indifferent to the resurrection of the world of conscious values; but is what makes the new world continuous with the old and conditions the possibility of its appearance. The continuity of experience, therefore, is conditioned upon the continuity of the time-process, presupposes that negative time-value which makes continuous transformation of the habit world possible. Whereas the gaps of experience cannot as such be reduced to terms of significance, they lead to consequences as regards the world of significance which prevent us from regarding the intervals as mere construction *in vacuo*. The world of significance before and after a night's sleep is by no means the same.

(*d*) The Qualitative View of Time does not account for the Variation of Duration Qualities.

Furthermore, if time is to be regarded as a qualitative series, how are we to account for the variation in quality, including duration quality? As each position in the series constantly changes its value, each position must be determined by an indefinite number of values or, in so far as we regard experience as an infinite quantity, by an infinite number of values. Instead of having one time perspective to express the values of history, we should need an infinite number of perspectives from an infinite number of points of view. Each moment of experience, namely, gives rise to a new perspective by altering all the values of the positions in the series. As the other positions coexist in a series this means, of course, a new perspective from each point of view or position and so on *ad infinitum*. But, if the variation of perspective can only be accounted for with reference to time, it would obviously be begging the question to try to express time as a perspective. It is the infiniting process of time which makes all our perspectives relative.

(*e*) The Conception of the Infinite does not Lessen the above Difficulties.

But it might be argued at this point: "Don't allow the infinite to frighten you. The completed infinite has lost its terror for mathematics. In order to explain the character of time all we have to do is to assume an infinity of qualitative perspectives or values and thus at once have the music of the world. Furthermore we can thus solve both the problem of the continuum and of variability. The mathematicians in the case of the number series have been able to define a qualitative series as both continuous and infinite. Not only is the series of whole numbers infinite, but by introducing the fractions and the irrationals, constituting infinities of other orders or *Mächtigkeiten*, we are able to define a qualitative number continuum. All we have to do, then, is to suppose time to be such a continuous scale of values or infinity of perspectives and the problem is solved."

I dare not enter the bewildering mazes of mathematical infinity. I suspect, however, that in so far as the number series can be conceived to be continuous other considerations beside qualitative or order-considerations are introduced. It is difficult to abstract from the quantitative character of number, and, of course, in so far as we presuppose the idea of continuous quantity we are merely begging the question. An ideal exhaustion of all the possible positions as such would not furnish continuity. The continuous line is not composed of positions, no matter of how many *Mächtigkeiten*. In order to get continuity you must introduce besides a negative value, which shall make these positions flow into each other. This is impossible, as Cayley[1] pointed out, apart from motion, and motion presupposes time. In so far as in this respect they flow into each other, they cease to be qualitative positions. Quality remains in nature discrete, and to establish continuity you must have reference to another order of reality. The qualitative diversity as such can as little be made to yield a continuum, as can a mere continuum, in the aspect of its being a continuum, be made to yield qualitative positions.

But we are concerned here not with infinities of abstract reflection or mere ideal description, but with the existence of experienced qualitative positions and with their variation. These positions are in their nature discrete. They are also at any moment a finite number. Infinity does not pertain to them, but to their variation; and it is this variation which we identify with the time character of our world. We cannot say whether the history of experience is ultimately infinite or not, though the time process must be thus conceived. Only in so far, of course, as the time process results in experience, does it give rise to qualitative diversity and perspectives. But we can say that a conceived infinity or order of infinities of ideally coexistent positions, does not touch the time character, which cannot be identified with the coexistence, but on the contrary must be identified with the variation of values. In a time world there is only one real perspective. If we choose to conceive a world of an infinity of perspectives coexistent at once we have a right to do so; only that is a timeless world and not our world. Time in such a world would vanish into the valid scale of the significance of the now. The contradictory character of such a world we shall examine later.

(*f*) The gravest Objection arises from the Concept of Series.

But a more serious objection still remains, which cuts the very ground from under the theory. The concept of series has been taken for granted in this discussion. This requires more careful scrutiny. Series is indeed very fundamental for knowledge or *concipi;* but it cannot be regarded ultimate as regards existence or *esse.* We cannot ascribe the idea of series to the perceptual world as such. In other words, series is not a simple datum, but involves presuppositions. Series is a purely ideal construction. This becomes clear the moment we inquire into its nature.

---

[1] *Encyc. Brit.*, 9th Ed., Article, Geometry.

Series involves two aspects, qualitative difference and order or direction. The qualitative theory of time, as discussed above, has emphasized the qualitative difference and taken the order character for granted. But series is not a mere mass or collection of qualitative positions. Series involves discrimination, abstraction, comparison, etc. In other words, series has reference on the one hand to the functioning of a subject, on the other to a certain character of the content. On the one hand series as such is not *given;* it is not something in things but in us. On the other hand series could not arise except for a certain constitution of the world. We cannot conceive of series in a static world, because in such a world abstraction would be impossible; the perceptual and ideal would be inseparably agglutinated. In so far as we can conceive of such a world at all, it would be mere presence or sensation. We can abstract the ideal from the real, because reality first does it for us. It is because our percepts are transformed into memories, images and meanings which we can carry about with us in our heads, but which do not involve the sort of action the percepts require, that we can abstract, yes, even abstract in the presence of the percepts. Abstraction thus already involves a pluralistic and changing character on the part of the world. Thus abstraction presupposes time-process, a converting of sensational presence into habit or structure, functioning independently of that presence.

Neither can we conceive of discrimination in a static world. Such a world would be the mere zero of mysticism. Discrimination involves activity and thus presupposes time-process. It is because on the one hand contents roll apart or appear in varying contexts, and on the other because we can vary our attention that discrimination becomes possible. To the glassy stare of the static absolute there can be no difference; it is all one to it. What the absolutist forgets, when he carries his discriminations bodily into his conceptual, static absolute, is that these are the results of a time experience. Discrimination, then, presupposes time-process.

Comparison and selection for a certain purpose, which are involved in the ordering of data, also involve active functioning on the part of a subject and hence are processes in time. Series thus shows, both as regards its content and its form, its relative character, its dependence upon time-process for its existence and character.

It is true that the time-series so called, or the historical series, holds a peculiar rank among series. It is prior to and includes them all. It is the registration of the time-process as such. It therefore furnishes the data for all series, as all series which are constructed are its heritage. As the registering series it has, moreover, a peculiarly factual character; it is objective to our conceptual processes, which must accept it as a datum. It is prior to reflection; and discrimination and selection are here at first the result of the evolution of the race rather than of the individual. But just because it is so fundamental it indicates, as no other series, its relativity to a certain constitution of reality. It, as no other, shows the ultimately dual character of our world. In so far as it means a *time* series, it points to a negative character of the world, which must account for its ideality and the variability of the values it means to embody. In so far again as it is a series it points to a relatively constant character of the world, namely, the habit character, which makes at least a relative record possible, and thus makes possible the world of order or significance. Time-series at any rate presupposes time-process, and thus cannot be made to define the time-character it presupposes.

It may be argued at this point, by some philosophers of the antiquarian type, that logic has nothing to do with genesis or process, but merely with nature or significance. These forget that a complete definition of nature must include genesis; that the only ultimately explanatory concepts must be constitutive concepts; that we can only know our world in so far as we can conceptually construct it. In such conceptual construction or making of our world we find that time and habit are ultimate concepts and that all significance presupposes these.

We have discussed so far the genesis of series and have shown that it is through and through relative to time-process; that it presupposes a changing and a pluralistic constitution on the part of the world. We found that the time series as no other points to a dual character beyond it in order to explain its significance. If again we take series in its abstractness as an existent order, as already formed, this has the character of *simul* or timelessness. This is based upon a habit structure of the world, which indeed is relative to time, but in so far as existent is antithetical in nature to time. The reason that, by means of processes in time, we can relatively annihilate time is because the time-character is limited by another character. For discrimination, comparison, and ordering to be possible, the contents must be present at once to consciousness. We cannot compare present terms with non-existent ones; we cannot order that which is not there. Series thus, as involving existence or presence of both form and content to consciousness, has a character essentially antagonistic or contradictory to time. It involves that other character of the world, namely habit. Habit or structure is essential for significance, and the more complex and relatively stable the structure, the more intense and rich is the meaning. Absolute chaos would not mean intenser consciousness, as Charles S. Peirce seems to suppose; it is a mere conceptual limit, is mere zero as regards content.

The world of serial structure and reflection as abstracted from the time-subject and regarded as mere content or meaning is the type of the eternal. But the eternal is after all an abstraction from a real time-process to which its significance is relative. It is only in its abstractness that it is timeless. The eternal or the world of significance is a derivative of a habit-taking time-process and shows its relativity to this.

II. *Time as an Ideal Quantitative Construction.* — This view of time identifies time with the measurement of time. Stating the matter this way at once makes clear the circle in the definition. But the theory is so old and venerable that it perhaps deserves a closer scrutiny. It was only through quantitative comparison in fact that time could become a social concept. Plato and Aristotle practically agree in making time 'the number of motion'[1] as measured by the heavenly orbits, though Aristotle, with his respect for common sense, cannot help noticing too its negative character. The historic perspective is surely a quantitative order and not merely a qualitative one, as we have pointed out above. Let us now examine a little more closely the notion of time as a pure quantitative construction, as Couturat terms it,[2] and see what it involves.

(*a*) What we have already said about Series holds of Quantitative Series.

In criticising the quantitative view we shall not take up the concept of order or series again. We do not hold with Bosanquet that all series are quantitative. That surely would not apply to such series as color or brightness or sound. In so far as quantity depends upon number, however, for its scale of values, the criticisms in regard to the order concept in general would apply here. We shall confine ourselves here to pointing out the relation of quantity in general to time; and if we find that the concept of quantity is derivative in character and presupposes time, then time cannot in turn be derived from quantity.

(*b*) Quantity depends upon Time-process for its Genesis.

Quantity arises only through reflection and comparison. In so far as it involves size or voluminousness it has indeed a basis in qualitative experience. But we cannot speak of quantity except with reference to comparison and standards. Quantity arises in stating one process in units of another process, regarded for the purpose in question as stable. It is necessitated by the social demand for description and common action. As reflection and comparison presuppose time process, hence quantity is necessarily derivative in character.

(*c*) The Relative Nature of the Quantitative Unit.

The relative nature of quantity appears the moment we begin to examine the quantitative unit. If quantity were absolute, it would contain its own standard or measure. But there is no absolute unit of measurement. All quantitative standards are relative and arbitrary. They are the result of social convenience and agreement, but have no absolute basis. The time process continually eats into our standards of measurement. This is nowhere more obvious than in our measure of the time-process itself.[1] The earth-clock is necessarily our standard clock. But the earth-clock, too, runs down, not fast enough to affect room-rent or interest, but still it is surely running down. Mr. Higgins, as quoted by Clifford, thinks that the effect of the tides is to diminish the orbit of the earth and increase its velocity, which would of course alter the absolute ratio. The present theory seems to be that the velocity is decreasing owing to tidal attraction. But this alteration is so infinitessimal with reference to our work-a-day lives that it does not practically affect them.

---

[1] Plato, *Timæus*, § 38, and Aristotle, *Physics*, Book IV., § 11.

[2] Couturat, article on 'Time and Space,' *Revue Met. et de Morale*, 1896.

It is only through motion that we can obtain a quantitative unit. In a static world, where motion, comparison and superposition would be unknown, it would be impossible to speak of a unit of quantity or measurement. As quantity thus presupposes motion and time, it cannot help showing its relativity to time. But if quantity presupposes time, it is defining in a circle to define time as pure quantity.

But quantity shows its dependence upon time not only as regards the genesis and relativity of its standards, a continuous quantity cannot be defined apart from time. A continuous quantity, namely, is undefinable apart from motion. An infinite aggregate of positions cannot give us a continuum. The only way we can generate a line from a point or a surface from a line, or a solid from a surface, as made clear by both Cayley and Clifford,[2] is through motion. But if the definition of continuous quantity presupposes time, then to define time as quantity is obviously defining in a circle.

Moreover, time as pure quantity would be indistinguishable from space as quantitative. In scientific calculations, where we deal with time as quantitative, we simplify our procedure by converting our time units into space units. Thus we have time = space = timelessness, which is absurd.

---

[1] Cf. E. Mach, *Science of Mechanics*, pp. 222–224 (Open Court, 1893); Karl Pearson, *The Grammar of Science*, Chapter V., § 13, 'Conceptual Time and its Measurement.'

[2] Cayley, article, 'Geometry' (first part), *Britannica*, 9th Ed.; Clifford, Essays, *Philosophy of the Pure Sciences*, Section III., 'Postulates of the Science of Space.'

(*d*) Relativity of Quantitative Description as Confessed by Science.

But though science may find it convenient to regard time as quantitative, it points everywhere to a more ultimate character of time to which quantitative description is relative. This is true even in pure mathematics. We have seen already that the fundamental concepts of geometry are undefinable apart from motion and therefore involve time. If we take algebra, this, too, in so far as it involves order, presupposes time. Take any simple relationship such as $a + b \times c$; and in so far as this involves that one operation must be performed before another, we have here an element which is not quantitative but upon which the validity of the quantitative operation depends. A timeless coexistence of the acts would not answer the purpose. In other words, wherever the validity of our procedure depends upon the categories of before and after, there we presuppose real time process. That number presupposes time we have already pointed out.

When we take up the sciences which deal with process, the idea of irreversibility confronts us; and the concept of irreversibility presupposes time for its definition. Energy does run down; and LaGrange, therefore, speaks of time as the fourth dimension, in which energy disappears. Tait, in his Thermodynamics, p. 38, in treating of the original distribution of heat, speaks of 'a certain negative value of the time for which the formulæ give impossible values'; and the same idea of the inadequacy of quantitative description leads Clifford to speak of changes as 'catastrophes.' Quantitative science, in other words, must remain hypothetical. It must always deal with a given condition of being, with a now; it cannot, in the nature of things, deal with process as such or with being which is not what it is.

If we take history in any of its phases we find that the time character is bound up with its peculiar kind of facticity and prevents us from writing history *a priori*. History is not a merely quantitative or logical system; it involves chronology, a factual order of before and after, which presupposes time.

Economics, in which some of the most brilliant analysis of modern times has been done, was perhaps the first of the sciences to discover this more fundamental character of time. Its aim from Adam Smith to Ricardo was to reduce value to terms of labor. It found, however, that value could not be reduced to mere terms of the now. Beside the element of labor the element of waiting may play an important part; and the mental attitude of waiting is conditioned by time. No amount of labor *now* could convert new wine into old wine. There is a difference in quality here, which is conditioned by a time-process. In the definition of interest the element of waiting is especially prominent.

If we take again the sciences which deal not with objective but subjective processes, the time element becomes even more obtrusive. In psychology change and novelty become especially prominent. We have discarded the notions of the 'associationists' that ideas can be poured from one skull into another as so many beads. The mental elements are nothing apart from the unitary state of which they are parts. A new state of consciousness, moreover, is not merely more of the old, but an absolutely new fact. In the irreversible process of consciousness we have direct knowledge of the time process and its ever changing values.

(*e*) Inadequacy of the Quantitative Conception of Time as Revealed in Time-measurement.

But the inadequacy of the quantitative notion of time is nowhere more obvious than in time-measurement itself. Let us imagine a celestial being, built upon the principles of a quantitative ideal of science, paying a visit to our empirical world and catching sight of a time-piece: 'Hello there,' he says, 'what's that?' And on being told that this is an instrument to measure time with, he asks: 'Well how much time is it?' He is told that it is one hour and thirty minutes. 'All right,' he says, 'one hour and thirty minutes.' 'No,' the terrestrial being says, 'it is now one hour, thirty minutes and five seconds.' In blank astonishment the celestial replies: "You say it is one hour and thirty minutes, and you say it is one hour, thirty minutes and five seconds, which do you want me to believe?" 'No,' the terrestrial says, 'it is one hour, thirty minutes and thirty seconds.' 'You are a liar,' says the celestial. 'No,' says the terrestrial, 'look and see, it is just one hour and thirty-one minutes.' By this time the language of the celestial is not such as ought to be heard by mortal man, and so we will close the interview.

This strange conversation, however, has taught us something about the relativity of ideal description and its falsity when it pretends to exhaust real process. There is an impossible value, which our equations cannot express; and that is precisely the negation of any finite value and its transformation into a new. The time character involves precisely the relativity or falsifying of any description which tries to exhaust the real subject-object. Time *creeps into* our world of description and negates it.

(*f*) Conclusions.

We have arrived so far at the following conclusions: First, time cannot be stated as a series or order concept, because the series and order concepts already presuppose time in their genesis, and once constituted involve the coexistence of the terms within the timeless meaning of the subject. In the second place, time is not reducible to terms of pure quantity, for quantity, both as regards its continuity and the constituting of its unit, presupposes motion and motion can only be defined in terms of time. In general our result so far is that time cannot be defined as an ideal construction merely, whether qualitative or quantitative, but is somehow involved in the nature of the real subject-object — is a property or substance of the real world.

C. *Time as a Material Concept.*

I. *Time as a Real Series.* — It has been argued that if time cannot be a merely ideal construction, we can at any rate regard time as a real series or as real moments. This seems to be the view advanced by M. Bergson in his notion of a *durèe réelle.*[1] This real duration is somehow to be a series of active and discrete moments based upon the principle of altering repetition;

---

[1] See *Revue Met. et de Morale*, article by Couturat, 1896, p. 664.

or time is to be regarded as a real irreversible series. This seems to be essentially the conception of time which Zeno of old had in mind and against which he hurled his dialectic weapons. This type of time would evidently, as we have already shown and as pointed out by Couturat, make motion and continuity impossible. M. Evellin tries to come to the rescue of the theory by assuming a zero distance between the real moments of duration. This, however, merely assumes the time-continuum and does not explain it. Were time ultimately real moments, a time-continuum would be impossible. But even if we assumed such a continuum of contiguous moments, this would make impossible any passing from one moment to another, which is just the time character. Anything like identity and causal explanation of process would be impossible, and we should have to fall back on the miraculous for any change of scenes.

Authors, who like Lotze[1] and Wundt[2] distinguish between time as an ideal order and an empirical succession or series, do not improve the situation much. The question arises: How is the ideal order related to the empirical succession? It is difficult to see how an ideal time, which must be regarded as an *a posteriori* construction, can in any way condition the succession of moments. But if the content of time is to be the passing of moments, then time itself cannot be moments.

But the whole notion of a real series of real moments is nonsense. There is no such thing as a *given* series or *given* moments. These are already, as we have seen, the result of ideal construction and essentially timeless.

We cannot conceive of time as serial without making both truth and reality impossible. Make time serial in character and you have this dilemma.

1. If you assume your time series to be real, then you have the coexistence of an indefinite number of real, exclusive moments claiming the same space, for each moment of time claims the whole of concrete perception with its dimensions. But reality cannot be both one and many in the same respect, hence reality becomes impossible.

---

[1] *Metaphysic*, Vol. I., chapter on 'Time,' p. 350, Clarendon Press, 1887.

[2] *Logik*, 1st Ed., Vol. I., chapter on 'Time.'

2. But if the time series is regarded as ideal, then we have an indefinite number of descriptions or judgments, each exclusive of the other and each referring to the same reality at the same point. Hence our descriptions or judgments claiming to be diverse and yet of one reality, in the same respect, are contradictory, and truth becomes impossible.

The only possible solution, as we have already indicated, is to regard time as non-serial or prior to series and to regard series as a derivative construction. Time must, somehow, be involved as a property or substance of the real, conditioning the whole world of subjective construction.

II. *Time as a Property of the Real or a Substance.*[1] — We may state the difficulty in the definition of time in the form of an antimony. J. S. Mill, in his *Examinations of Hamilton*, raises the question of how the past and the future can coexist in the present. That they do so, he regards as a fact; but how they can do so he regards as an ultimate mystery.

1. Antinomy of time.

(*a*) Such is the nature of time that when the present is, the past has been and the future is not yet. The present is a mere point or ideal boundary making the past continuous with the future, but is not itself time. This is the character of time which Aristotle, following common sense, lays down in his Physics.[2] This emphasizes the non-being aspect of time without distinguishing between this and the quantitative and serial characters. This gives us the mathematical present, which is a mere limit or zero.

(*b*) But the past and future must coexist in the present, else how can they be contrasted in judgment or mean past and future? Past and future are precisely present attitudes. Time is nothing but an ideal order. This would give us the metaphysical present emphasized by such philosophers as Kant, J. S. Mill and the idealistic school.

2. Solution of the Antimony.

---

[1] Substance is here used in its scientific sense, just as we assume ether for the convenience of description. It seems to me that we require a negative substance as well as positive ones in order to have a complete description of the world.

[2] Aristotle, *Physics*, Book IV., Section 10.

(*a*) The Psychological Present.[1] This view attempts a compromise between the views already stated. The present, it holds, is not mere zero, but has duration. The present and future as the waning and rising processes of consciousness really do coexist in the present within the limits of a few seconds. Beyond that they are ideal constructions. Our time judgments thus have a real basis. But this duration character must not be absolute, for in that case we should have absolute bits of duration, which would make continuity or flow impossible. The time character, as we have already shown, must be identified precisely with the waning or rising, with the fleetingness of experience. The relative duration does make possible measurement and judgments of time, but is not itself time. The psychological or 'specious present' assumes the quantitative nature of time and so fails to solve the antimony. This arises from regarding time as a quantitative series, instead of emphasizing its non-being character as its ultimate nature and regarding the quantitative and serial character as an *a posteriori* construction.

(*b*) Time and the Judgment. It is evident, in the first place, that time does not pertain to the individual act of judgment, *i. e.*, to the validity or meaning of the judgment. The parts of the judgment are not separated in time, though it takes time to speak the judgment. Each judgment is a timeless synthesis, involving an ideal reference or interpretation transcending the time-process.

But judgments are relative, though they mean to be true. The question arises how to account for the discrepancy of judgments, made with reference to the same point in space, in the same respect, without contradiction. We can have different judgments coexisting in regard to different points or different aspects; but how can we have different judgments on top of each other, as it were, claiming the same point? This can only be because of a certain inherent principle of diversity or non-identity in the point so that the point is not what it is, that there is negation of its being; or because a different subject is making judgments of the same identical point. We must introduce a non-spatial, negative dimension of being, a pure dynamic principle, which shall necessitate incompatible judgments with regard to reality. By incompatible judgments we mean such judgments as that the rose is red and not-red with regard to the same spatial point.[1] It matters not whether the difference is regarded primarily as creeping into the real object or into the real subject, in either case it means ultimately a different subject, incompatible with the subject or meaning claiming to be the same. All change resolves itself for knowledge into change of point of view or new experience.

---

[1] W. James, *Principles of Psychology*, Chapter XV., 608–610.

We can define, then, the relation of time to judgment: Time is that property of the real subject-object, which makes incompatible judgments (*i. e.*, different judgments as regards the same attribute of reality at the same point) necessary.

Time, then, must be defined as non-being, not relative non-being merely, which has to do with difference at different points of reality, but absolute or dynamic non-being, as real and ultimate as the habit or structure aspect, which it makes relative and which in turn limits and defines it. The ultimate nature of reality must be defined as a habit-taking time-process; or, emphasizing the structure aspect, such is reality that time creeps into all our systems of truth and falsifies them, necessitating new ones.

Having once defined the real time-character, we can easily account for the serial aspect of experience as expressed in the historic series of past, present and future. These do not by their sum constitute time. They are derivatives, on the contrary, ideal constructions or will-attitudes, necessitated by the relation of the time character of experience to the habit character, and remain to the end relative. The past is the attitude toward the content which time has negated and transformed and which therefore can no longer as such be acted upon; the present is the sense of real activity or the going on of process; the future is the expectancy or attention toward the coming or new content, the field of real possibility. The irreversibility of the past, on our theory, is not ideal merely, but is due to the real negating and transforming of the world of experience for which the present past-symbols stand.

So much for the logical aspect of the problem; the epistemological and metaphysical implications will be developed later.

---

[1] Cp. Sigwart, *Logic*, 2d ed., Vol. I., p. 139 ff.

CHAPTER II.

TIME DEFINED IN RELATION TO OTHER CONCEPTS.

A. *Time and Space.*

Taking time as a series has led to confusing it with several other series concepts, especially with space and number. As brilliant a thinker as Münsterberg goes so far as to say that whatever holds true of time is equally true of space. Both involve qualitative positions; there are time-qualities just as there are space-qualities. In both we have the nearer and the farther with reference to a willing subject. In both we depend upon social agreement for objectivity. In drawing these analogies Münsterberg, of course, identifies time with the historic series. But just in so far as we fail to distinguish time from space, must there not be something seriously wrong with the definition proposed?

So far from time and space being identical in meaning, they are antithetical. Precisely the opposite of what is said of space must be said of time. Space involves the habit character, or the relatively permanent character of reality, whereas time expresses its fleeting or unstable character. In so far as we emphasize the spatial character of the world we have free mobility or reversibility; we can pass backward or forward over our series with entire indifference; we have absolute identity of content. In so far as we emphasize the time-character, we cannot bathe in the same stream twice; we cannot live over again a content once had; we cannot by passing through certain intermediaries go back to any content in the past, for the real qualities or points have vanished as such and been transmuted into the ever-changing present, the past and future being merely ideal constructions.

In emphasizing space, we emphasize the world of possible perception, of present or actual relationships, the world of scientific description. In emphasizing time, we emphasize the impossibility of perception, the instability of the present, its transformation into that which is no longer, or is not yet, the indescribable, because non-existent. The two bear, therefore, opposite relations to the active subject. Space, again, is conceived as a system of coexistent series, whereas time is nonserial, is presupposed in the very possibility of the arising of series, and makes all serial description relative. Space and time, in short, express antithetical aspects of reality.

But just because they express aspects of the same reality, they limit and supplement each other. Without the negation or passing of time, space would fall asunder into discrete positions, as we cannot conceive of the continuity of space without motion. Time is bound up with the fluent or continuity aspect of our world, whereas space is bound up with the diversity or habit aspect, the serial aspect. Without the relatively stable space system again, we could have no measurement of time process, no quantitative units, and time as a negative property would be inconceivable. Whereas time therefore conditions the arising of spatial series, is involved in the *ratio fiendi* of space, space as a system of relations on the other hand conditions the knowing of time, is therefore the *ratio cognoscendi* of time.

Space again as the realm of determinable relationships presupposes dimensionality. (We are using dimension here in its ordinary quantitative acceptation as referring to the number of coördinates, not in the qualitative sense employed by Teichmüller and others. According to the latter view there are as many dimensions as there are differing qualitative positions. The number series on this view would, therefore, have an infinity of dimensions. Time, likewise, if taken as an order series, would have an infinity of dimensions. This terminology, however, does not conduce to clearness.) How many systems of coördinates are required to define position in our space is a purely empirical affair and is determined by convenience in the adjustment to our actual perceptual world. As time as such is prior to series, dimension as applied to it can have no meaning. However, inasmuch as time negates any empirical system of facts, and thus continually converts real space worlds into ideal space worlds, all exclusive of each other; and inasmuch as at present there are as many systems of significance, each filling the whole of space, as there are individual life histories, we may speak of time, though not itself dimensional, as giving rise to an infinity of dimensions by giving rise to an infinity of ideal spaces or worlds of significance.

Speaking of time as having one dimension is, as we have pointed out before, a mere spatializing of time and loses sight of the essential character of time. Speaking of time again as a fourth dimension, as La Grange does, is only excusable if we mean that time is a different sort of fact from space, and even then it is misleading. If energy disappears from space, or arises in space, it does so absolutely. Its doing so would indeed be a time fact, but would have nothing to do with a fourth dimension.

Empirical space, then, is the present system of relationships, of possibilities of perception, whereas time is the negative property which makes all systems unstable. Space as the world of description, or as a system of ideal geometrical relations, abstracted from the time process, is the eternal aspect of the world, which, however, when looked at from the point of view of significance or concretely, is ever transformed through the negation of time into a new space. Space, eternity, the *simul* system of significance, must be considered as derivative in relation to the time process, which ever looks upon itself anew under the same formal limitations.

B. *Time and Irreversibility.*

Space is often spoken of as a reversible series to contrast it with time which is spoken of as an irreversible series. But, in the first place, to speak of an irreversible series, if we emphasize the strictly serial character, is nonsense. If all the positions coexist *simul*, as they must do in a series, reversible and irreversible can have no meaning. The coming and going of contents is as such not expressed through the serial character. Reversible and irreversible apply to operation or process, not to series. Now, strictly speaking, there can be no such thing as a reversible process. This would be a process in which nothing happened. If there is activity at all, there must be a transformation of old habits and the forming of new. Absolute identity, which reversibility presupposes, is the very opposite limit from process. If we speak of a reversible process, we must remember that we are dealing with an abstraction, that we choose to neglect entirely the qualitative and time aspect of process, and deal with its purely formal aspect. Thus in speaking of free mobility in space, we disregard entirely the real diversity of the empirical world, which we leave for the physical sciences to determine.

What constitutes the irreversibility of process is that the content or habit aspect is ever transformed, and thus the old content is negated and made unreal. The reason we cannot act on the past is that it no longer exists. The past, that was, has been converted into present habits and suffused with present meaning.

In speaking of irreversibility, however, we may regard it subjectively or objectively. Inasmuch as all process is irreversible the subjective activity, or the registering and interpreting of process, must always be irreversible. But as we may abstract the social object from the subjective operation, we may hold that, though the subject changes, the object remains identical, the subjective operation not affecting the social object. Thus in the Hegelian view of the world, the system of significance or the logic of experience is always complete, yet the individual in learning it passes through a time process. Of course, thus to treat the object as an independent ideal construction is a mere abstraction. The real object, as the real subject, is a process; and though the real object may not vary in the same degree as the subject, yet the universe must be conceived ultimately as a composite, irreversible process. Our ideal constructions are indeed timeless, but only so long as we divorce them from an appreciating subject. The reflection upon an act of consciousness is not the identical act over again, but a new act including the significance of the preceding. Inasmuch as irreversibility thus presupposes process, and process involves time and habit, we cannot speak of time as irreversible.

C. *Time and Number.*

Those who have made time an order series have found it difficult to distinguish time from the number series. Some have gone so far as to identify the two. If the two terms, however, embody the same meaning, then it would apparently conduce to clearness to drop one of them; it would save the uninitiated from getting confused. If, on the other hand, time and number are really different concepts, and not merely interchangeable words, then it is surely inexcusable laziness to dump them together in that sort of fashion. Discovering their difference is surely as important in that case as discovering their likeness. It is time this passion for likeness at the expense of difference became bridled in philosophy. The reason for the confusing of time and number is doubtless to be found in the identification of time with the historic series. Even so, as we shall see later, it is a loose and unwarranted way of speaking.

Those who make this identification look upon both time and number as a qualitative order constituted by the reflection of the subject upon its own activity, the subject thus abstracting from its content and attending primarily to the form of this activity. Sigwart objects to this identification on the ground that whereas 'the basis of the connection between successive periods of time is the continuum of moments which pass into each other without a break; the acts which correspond to counting are limitations of a duration which always remains divisible and cannot be produced from a combination of unities.' I agree with Sigwart that a number continuum contradicts the essential character of number. If the number steps or qualitative positions, by heaping up infinities of different *Mächtigheiten*, can be made to disappear in a general continuum, we have obviously lost our positions and so can no longer speak of number. However, there is no danger of this happening provided we adhere to the qualitative character of number, any more than any infinities of ideal divisions of a line can be made to constitute a line. I cannot help thinking that the mathematicians lugged in unawares the conception of continuous quantity, or numbers as quantitative, and so are merely begging the question. For me, at any rate, ideal position and continuous quantity are different orders of fact and hence no infinities of one can constitute the other. The limit of the continuum, which the mathematicians seek in the case of number, is not in the same dimension with the positions that are to constitute it.

But while thus agreeing in the main with Sigwart's position as regards the discreteness of number, his statement in regard to time that 'the basis of the connection between successive periods of time is the continuum of moments which pass into each other without a break,' seems to me a hopeless jungle of confusion. If time is to be identified with numerically discrete and exclusive moments, bits of duration, on the one hand, it is difficult to see how, on the other hand, it is to account for the continuity of moments. Those who have made time identical with the number series have obviously identified it with the series of individual moments abstracted from the time process, whereas Sigwart identifies it both with the going on of process and the ideal construction of moments. If we regard time, however, as numerically distinct moments, it will be impossible to account for the continuity of moments, since the continuum, as we shall see later, presupposes time. On the other hand, if we identify time with the continuity character, with the going on of process, which makes moments relative, these moments become merely *a posteriori* constructions and do not touch the real time character. But we must take our choice between these alternatives. Time cannot be identified both with the going on of process and with the ideal or finite breaking up of the same for purposes of ideal construction.

If, however, we identify time with the discrete moments or the historic order, we find that the analogy between the historic series and the number series breaks down at many points. It is not true that each moment in history includes the significance of the preceding moments in the way each step in the number series includes the previous. Old age does not include childhood and youth in the way that three includes one and two. This is due to the fact that the number series is constructed in conformity to a voluntary purpose, expresses a formal law of the activity of the self, whereas the concrete historic series involves involuntary elements, must conform to certain objective data. This involuntary and uncertain aspect of history is due partly to the creeping in of time and partly to the pluralistic character of the world. In the empirical process no habits are absolute, but are subject to continuous transformation and effacement. In the historic series then there is a contingent or factual element; it is essentially *a posteriori*, whereas the number series depends upon the activity of the subject, and hence, as regards its formal aspect at least, is *a priori*. True, as regards its individual character, number too involves a contingent element which shows its dependence upon a time subject. But this contingency is peculiar to the activity of the subject and is not foreign or external to the subject. We can never doubt as regards number that each step has cumulative significance, includes the previous steps, whereas applying this idea to history, as was done by Hegel, leads to the grossest fallacies.

But a more serious objection still remains. The historic series, however much dependent upon time for its genesis, as an existent system of facts, as a now order, is timeless, is the manifestation of the habit character of the world *versus* the time character. Whatever seeming analogies can be drawn, therefore, between the number order and the historic order, they fail to touch the real problem. Number as an existent order, as a *simul* hierarchy of values, is an essentially timeless affair.

It will be seen that I regard number as primarily an order series; and, conceived as an existent order, I regard it as timeless. But while the number order cannot be identified with time, it does presuppose time. Any theory of number which does not take into account its genesis must be forever unintellegible; and it is as regards its genesis that the number order involves time in a peculiar way. Now number is distinguished from other order series in that it is absolutely cumulative. This we have seen cannot be affirmed of the historic order. Moreover it is possible to conceive of order series in which the significance shall not be cumulative. Take for example the white-black series of qualitative shades. If we pass from one limit to the other, say from white to black, we are not tempted to say that the black limit in any way accumulates into itself the significance of the intervening steps. We might as well have started at the other limit as far as cumulative significance is concerned. In other words, we here abstract the order from the activity of the subject and hence can treat it as reversible in significance.

In number, on the other hand, we have cumulative significance in such a way that each step in the series presupposes and includes the previous steps. Here what we are concerned with is precisely a subjective method of operation which crystallizes into an objective ideal order. If the crystallized scale of values as such is timeless, yet it has an irreversible direction to which attention must conform. It is in this that number shows its relativity to the time activity of the subject. It is because the previous steps or acts can be retained, and each later is recognized as one more, as a new fact, that we have the basis for the number series. Mere coexisting multiplicity could not give us number. Both the time character and the habit character of experience are necessary for the number series, the habit character as conserving the steps or rhythms of activity, and the time element for the negation of the old and the arising of the new, which gives us the succession of steps and the novelty of meaning. In the number order, however, as contrasted with the historical order, we abstract from the empirical limitations of the subject and take account merely of the repetition of will acts, irrespective of the variety of empirical content. It is thus we can conceive of the absolute increase and the infinity of possible values. Number, in other words, is not merely an involuntary registration but a purposive construction.

But not only the cumulative significance of number but also its individual significance shows its dependence upon a time subject. Each step not only has a cumulative character, due to its position in the series, but also an indivisible or individual character. This is what constitutes the empirical aspect of number, so baffling to the mathematician for example when he tries to find a formula for prime numbers. This individuality of number is due to the fact that each number step is a unique will attitude or attention act exclusive of any other. As this will attitude is negated or transformed, a new attitude takes its place, each number step thus standing for a different time subject. In emphasizing thus the individuality of number we emphasize the freedom or spontaneity of the subject, while in emphasizing the cumulative character we emphasize the necessity aspect. Number, then, embodies the law of the pure activity of the subject as a time yet habit-taking subject.

Once, however, the succession of cumulative individual time subjects has crystallized into a scale of significance, once the subject has reflected upon its activity and discovered the law of the repetitive embodiment of its will as abstracted from empirical limitations, the number order becomes insofar relatively independent of time. We do not need to count to know the meaning of any number step, once the series has been established. Thus in the order 1, 2, 3, 4, etc., the steps are present in the same sense namely as ideal significance, whereas in counting 1, 2, 3, 4, etc., in counting 4 this is present in a way 1, 2, and 3 are not. In the former case we treat of number as an ideal construction, in the latter we emphasize the successive aspect, which, of course, is prior to the series or is series in the *making*. We may say, then, that number is relative to, and presupposes, time as regards its genesis; but is relatively independent as regards significance, provided, however, that this significance always bears marks of its relativity and derivation.

Attempts have been made to define the nature of number without reference to time. This, it seems to me, is involved in Dedekind's attempt to define the number series as a completed infinite. For Dedekind the nature of reflective thought as returning upon itself, as the reflection upon the reflection, and the reflection upon the reflection upon the reflection and so on *ad infinitum*, furnishes the basis of the number order. The problem of number thus becomes, as Professor Royce points out, essentially the problem of self-consciousness. The reflection upon self, however, is no more a basis of number than the reflection upon objective contents. On the contrary, the interest in ordering things must have vastly preceded the interest in subjective reflections as such. When, however, in either case the subject tries to understand number, it must be by abstracting its order of activity from the various empirical contents, toward which it is directed, whether subjective or objective. What is needed ultimately is pulses of thought, a succession of reflections which cumulate in significance as acts of one subject.

What we hold, therefore, and what Dedekind seems to neglect, is that these acts of the subject must originally be time acts for the cumulative and individual significance of number to arise. Even if we took for granted the completed infinity of reflection, as the reflection upon the reflection upon the reflection upon the reflection * * * to infinity, this would not give us an order. There would here be no steps, since all this would be present at once, but merely the one fact. To obtain a basis for the number series we need so many individual acts of reflection, each act being transformed and persisting in the new. This is impossible except in a time process. It is the time element which negates the old and gives rise to the new, while it is the habit character which gives rise to the cumulative significance. Number, therefore, presupposes for its genesis the concepts of time and habit.

The infinity of number, moreover, as all infinity, is merely hypothetical. Empirically number is always finite. It could become infinite only if we supposed an active subject as freed from all empirical limitations. This, however, merely amounts to saying that, abstracting from the empirical limitations of its activity, the subject discovers the law or rationale of repetition which gives us the basis of number. This has nothing to do with the contradictory idea of an actually completed infinite.

D. *Time and the Infinite.*

Treating time as a series has always given rise to a great deal of speculation as to the infinity of time. There can be no doubt that the concept of infinity is closely bound up with the concept of time. Let us try to find what the relation is.

First, however, it is necessary to make clear what is meant by the infinite. It is now a commonplace to say that we must not confuse the infinite with the indefinite; and in the main it is well to emphasize the distinction, though, as we shall see later, the empirical infinite must include an indefinite element. The Greeks in general confused these concepts, or rather with them the infinite meant merely the indefinite, and hence their moral degradation of the infinite. Aristotle, however, attempts to distinguish between what he calls the false infinite or indefinite and the true infinite. The straight line is his example of the former and the self-completed circle of the latter. This idea of formal completeness is indeed an important element in the definition of the infinite. The infinite in other words is as definite a concept as the finite. But that surely is not sufficient to differentiate the infinite from the finite. Why the circle, for example, is more infinite than the straight line I cannot understand. I suppose the reason for it must be that it is without end. That recalls a story about the Jew's eternity trousers. A Jew advertised eternity trousers and a countryman came in and bought them, supposing that they would last forever. They soon wore out, however, and the countryman brought them back complaining that he had been cheated. The Jew, however, ingeniously replied that eternity means without end, and that being the condition of the trousers, he had fulfilled his side of the bargain. But, jesting aside, the circle is just as finite a concept as the straight line. We can compare and measure circles as easily as straight lines. It is true that the circle and the straight line are incommensurable, but that would speak as much in favor of the infinity of the straight line as the circle. Incommensurability is, however, a difficulty merely in stating a geometrical relation in terms of an arithmetical. Besides, as the smallest line can be conceived as infinitely divisible, it would be infinite too on the same principle.

It is true, however, that the conception of the infinite must have formal definiteness. The infinite series of $1 + \frac{1}{2} + \frac{1}{4}$, etc., whose sum is 2, is as definite an operation as that of $1 + 1 = 2$. In both the finite and the infinite there is a law that limits the operation or determines its form. The difference between the two lies in the fact that, whereas with the finite a limited number of steps or operations will satisfy the form, in the infinite no number of operations can satisfy the form. For merely formal purposes, however, just as soon as the law of the process emerges, further operations are useless. Once having discovered through ideal construction that $1 + \frac{1}{2} + \frac{1}{4}$, etc., has for its sum 2, there is no use in carrying on the operation any further. Whereas the finite, therefore, is limited both as regards form and content, law and operation, the infinite is limited in form but unlimited as regards content, *i. e.*, no number of cases of content can satisfy the demands of the form.

Now we may choose to disregard the content and deal merely with the formal aspect. If so, we have the hypothetical infinite, misleadingly called the completed infinite. It is not that the operation is complete, but that having obtained the law of operation we deal with that purely, *i. e.*, we deal with the limit, not with the operation. Such is the purely quantitative infinite already referred to. Such would be the infinite of reflection referred to above, which Dedekind lays at the basis of the number series, or which Herbart illustrates by the map which shall also be a map of itself. The law arrived at, however, in this infinity of reflection, is the futility of the attempt to reach complete identity of the self as subject and object; we have here no approximation to a limit. The answer to our question, as brought out by ideal construction, is that we are talking nonsense. The map cannot include a map of itself; the subject cannot at the same time be object, though it must be continuous with its object. Were it possible to carry the operation to infinity, we should merely discover that the attempt is infinitely nonsensical.

Not all infinite series, however, can be regarded from a merely formal point of view. Thus the number series, as we have seen, has a factual as well as a formal aspect. Instead of abstracting here from all operation, as we do in the quantitative infinite or the infinity of reflection, we abstract here from all conditions limiting the subject's activity. The subject wills to embody itself ever anew. In this absolute freedom, however, the subject discovers a law within itself, that of habit, such that each embodiment or act shall be conserved. In this freedom of pure activity crystallizing into habit, we have the basis of an infinite order series. It is not merely the hypothetical *simul* of an infinite series, but the actual activity of the subject, successive steps of reflection. We have here, therefore, a contingent or indefinite element, which cannot be determined *a priori*, viz., the individuality of each act.

In the infinity of the historic series, again, we have limiting conditions beyond the control of the subject, which render the content or operation side entirely uncertain and enjoin the waiting for the steps, the empirical results.

The infinite in any case involves a formal law or now constitution. This is true of the mathematical limit, of the pure activity embodied in number and in history. It is because of a certain constitution that the operation is limitless or inexhaustible. This is true, I said, even of the historic infinite. It is because of the now constitution of reality that no description can prove exhaustive of it. *Now* a changing habit-taking world, *always* a changing habit-taking world. On reflection, therefore, it must present the possibility of an infinite series of facts.

To speak of infinity, therefore, as pertaining to the presented data as abstracted from conceptual construction, in the way in which Spencer does, is mere nonsense. The pure presentation or sensation is indeed a limit, which we can never reach, because from the point of view of significance it is mere zero. But the sensation as such is neither infinite nor finite. Both finite and infinite have to do with ideal construction. This construction may be in subservience to a purely voluntary purpose, as in the mathematical infinite; or it may depend upon a constitution, which pertains to the subjective activity as such in the form of cumulative habit; or it may be limited by involuntary elements, objective entirely to the subjective activity, as in concrete life or history. But in any case, the infinite only emerges as a result of ideal construction, abstracting from the limitations of our own concrete lives and purposes.

The infinite, moreover, as an ideal construction, *i. e.*, in its formal aspect, is a timeless affair. As the infinite, however, presupposes operation, it in common with all series concepts presupposes time. Furthermore, the infinite always implies possible operation, and hence implies time. It is in the very inexhaustibility of the operation, demanded by the form, that the infinite differs from the finite. This, indeed, is emphasized in different degrees, as we have seen, in the various series concepts, according as the mere form or the content also is taken into account. In the quantitative limit, once having by means of operation or experiment arrived at the law, we abstract from the time element. In the number series again we cannot do so completely, as the order and individuality here presuppose the time-act. Finally, in the concrete historic series, we are at the mercy of time; and ideal construction is here only justified in so far as it conforms to certain data, objective to the individual subject.

If we ask then if time is infinite, we must answer that, inasmuch as the conception of the infinite presupposes time, it is begging the question to speak of the infinity of time. Whether in general any ideal construction, however, is to be regarded as infinite or finite, depends upon the limits the subject sets itself. If these limits are belief and action, individualization in short, then the concept becomes finite; if free play of purpose, irrespective of limiting conditions, then we have the infinite. Empirical reality, which forms the object of scientific research and furnishes the dimensions of empirical knowledge, is always a finite affair. Insofar as the world is empirically infinite, whether as coexisting or successive diversity, it baffles knowledge.

E. *Time and the Continuum.*

Treating time as a series, we have seen above, makes it impossible to account for the continuum. Let us try to examine now a little more closely the relation between time and the continuum. Can we speak of a time continuum? The old way of coördinating space and time as serial concepts has led to speaking of various kinds of continua, as the space continuum, the time continuum, the physical continuum, not to mention the mathematical attempt to define a number continuum. In all this there has been no serious effort to discover what is meant by the continuum as such, *i. e.*, to seize upon the essential character of the continuum. In the light of the fact already brought out that time is not serial, but on the contrary presupposed by all serial construction, it will be necessary to revise our notion of continua.

In the first place, it is necessary to point out that a valid continuum can only be obtained through conceptual construction, not through perception. All perceptual continuity, as Riemann and Clifford have pointed out, is open to doubt. We can never prove, as Clifford shows, that what appears as continuous is not objectively discrete. Thus the surface of the water and the pictures of the vitoscope appear continuous, though objectively we know they are discrete. The continuity here is in the perceiving subject, not in the perceived object. The microscope has taught us not to rely, therefore, on the seeming as regards the continuum. Moreover, what seems continuous with our present microscopic powers may prove discrete with the intensifying of our microscopic vision. The only way, then, that we can be sure that we have a continuum, is conceptually to construct one. If you ask, then, how we know that there is such a continuum, whether it is not merely an ideal construction, we answer that this is irrelevant for our purpose; but if there is objective continuity at all it must be thus constituted. Whether ultimately we must assume objective or physical continuity or not depends upon whether we need such a continuum for our knowledge of the world and our adjustments to it. If there is, however, any such thing as knowledge of the world and interaction within it, the world must be a continuum. The continuum, therefore, is an ultimate and necessary presupposition of knowledge and action, as without it communication would be impossible whether as regards the present system of space or the now ideal past.

How, then, must we conceive the continuum as constructed? It will be impossible here to give a history of the attempts to define a continuum. All we can do here is to point out, with Charles S. Peirce, two typical positions, the Aristotelian and the Kantian. According to Aristotle we have continuity when the parts have common boundaries. This is the definition adopted by Clifford. According to Kant, again, we have continuity, when between two points, however selected, a third can always be found. In other words, infinite divisibility is the character of the continuum.

To show the futility of the latter definition one need only bring up the series of rational fractions. This series would always admit of a fraction being found between any two fractions, however selected, yet the series is none the less discrete. We can never define a continuum, however, in this analytic way. No infinity of points can constitute a line, because they are facts of a different order from the line; as ideal abstractions they lack something essential to the continuity of the line. The plausibility of this definition comes from the fact that we presuppose the very thing to be defined and so define in a circle. Having the continuous line, for example, we can easily conceive the possibility of an infinity of positions, though we must not forget that the converse is not true, viz., that an infinity of positions constitutes a line. The Kantian definition, therefore, so prominent in modern mathematics, is a vicious circle.

Nor does the Aristotelian definition fare much better on critical analysis. If we already have a continuous quantity, then it is evident enough that parts of continuous quantity having common boundaries are continuous with each other. But if the definition already presupposes continuous quantity, then it presupposes the very thing which was to be defined, and we have another circle. Suppose we have a continuous surface. Let us divide this surface up by means of lines. Now any parts which have common boundaries, according to Aristotle, are continuous. But what makes them continuous? Is it the boundaries that glue the surfaces together? Suppose the parts were not continuous, could we by means of lines make them so? In other words, does the boundary constitute the continuum or does it presuppose it? It is evident that as no infinity of points could constitute a line, so no infinity of lines could constitute a surface. The line is a merely ideal division of a surface and presupposes the surface, hence does not glue together parts of the surface. Abstracted from the surface of which the line is a boundary it lacks an essential property of what goes to constitute a surface. Whereas the surface is infinitely divisible, no infinity of ideal divisions can constitute a surface.

The fundamental fallacy of the Kantian and the Aristotelian definitions is, therefore, the same. Both presuppose the very thing to be defined and thus define in a circle. With both, ideal acts of division are made to account for continuity, whereas infinite divisibility means merely that no number of ideal acts of division can touch or affect the continuity character. C. S. Peirce's attempt to combine the two positions is merely a double begging of the question.

What ought to be evident from the above is the futility of trying to define the continuum in static terms. Once conceive the universe as a system of ideal abstractions, and it remains eternally discrete; each abstraction remains in its own isolatedness. The abstractions as such have no power of gluing themselves together into a continuous whole. Ideal unity, therefore, always presupposes, and shows its relativity to the real continuum. There is no such thing as a series continuum taken in its strictly serial character. To define the continuum we must look to the process or operation side of experience, to its dynamic aspect. As Cayley points out in the article already referred to,[1] if we would pass ideally from the point to the line, we must conceive the point as moved; if we would pass from the line to the surface, we must conceive the line as moved; so with the surface and the solid. Motion supplies that element which negates the discrete positions, which makes the points spread and flow into each other; and that element in motion, which gives rise to this fluency is not the qualitative, habit, or space aspect, which on the contrary gives us discreteness of position, but the negative or time aspect, which negates the various positional values. The continuum, therefore, presupposes time for its definition. This is true whether we consider the individual history or the universe as a whole.

Let us first consider the matter of subjective continuity. What do we mean by the continuity of individual history? How is the self of to-day continuous with that of yesterday? We may say that the self of yesterday has passed into the self of to-day through a series of infinitesimal changes; but we must remember in that case that the series or degrees of change are *a posteriori* ideal constructions and presuppose both the going on of change and its crystallization into habit. These ideal constructions, moreover, are based upon certain characters of the present time subject. There are no past habits. All habits must belong to the now, though, as interpreted from the point of view of the time subject, they furnish the basis for the construction of the ideal series of the past and the future according to the will attitude of the subject towards its content. The continuity of the history of the self means that the self is ever transformed into a new self and that this transformation owing to the fact of habit is cumulative.

---

[1] Article on Geometry, *Encyclopedia Britannica*, 9th ed.

If the self is to be continuous there can be no such thing as a static present or absolute habit. If the present were even an infinitesimal bit or block of absolute duration the continuity of history would be impossible, and a *deus ex machina* would have to be evoked to account for the seeming continuity. We would then have to look upon history as a series of catastrophes or leaps, the difficulty being, however, that we should have to presuppose a continuum in order to make our catastrophical changes mean anything. Absolute discontinuity is inconceivable, as our discontinuities must always be estimated with reference to some continuous process.

Of course, I need not say here that the present I am speaking of is not a mathematical point or boundary. Points and boundaries, we have seen, are ideal abstractions and do not explain continuity. On the contrary, the present contains all there is of living reality, whether as data or the activity of ideal construction. The character, however, of the real subject is just to be other than itself, *i. e.*, to be a time subject. The direction and accumulation of meaning is indeed determined by the past; but the meaning itself, which suffuses reality, is ever a new meaning, which in turn thickens into habit. Time creeps into the present subject and makes its values unstable. What we have tried to show in regard to the self is that the continuous process is prior to the historic series and involves as its essential character the time-element.

What is true of the continuity of the individual self is true also of the continuity of the world as a whole. It, too, can only be conceived as continuous by being considered as a history or process, by being absolutely transformable. The problem here, however, seems more complex, as here we seem to have absolute coexistence as well as history. This is only true, however, from an abstract and partial point of view. It is true indeed that, try as we may, we cannot help recognizing an original diversity of habit-taking in the universe. But what prevents this diversity from destroying the continuity is the transmutability of each diverse habit structure in the process of the whole. This process indeed transforms each structure differently according to its own inherent character, but nothing remains static. If there were any such thing as absolute bits of stuff, absolute habits, then indeed the continuum would be impossible; but such atoms are the result of abstracting the diversity character from the process which owns it. If then we start with the universe as an exhaustive system of ideal positions, as mathematicians conceive number, we must conceive of these positions as spreading or moving into each other to have the continuous world. Each point of diversity thus describes lines or spreads waves that make it flow into all other points. It must be remembered, however, that these points are not mathematical points but physical points or real contents; and the lines or waves described in all directions are likewise physical. Thus the universe as a whole must be conceived as an infinite multiplex of infinite histories, all transmuted, however, and made continuous in the process of the whole. We can thus travel on the sunbeams in either direction, as Sylvester suggests, because each wave flows into the next wave, each wave embodying the history of an infinite past.

For various purposes of knowledge we indeed emphasize differently the various aspects of this process, as we try to show the empirical relations between these spreading centers of reality. Thus, for purposes of chemical analysis, it is the diversity or habit aspect that interests us primarily. Hence the atomism of chemistry. In physics again, as in accounting for light, radiation and gravitation, it is the continuity aspect which is of primary importance. Hence the perfect fluid and perfect jelly hypotheses here. Newton's first law of motion, likewise, abstracts from all diversity and resistance and treats the world as a pure continuum. These hypotheses, though one-sided, have their serviceableness in their own domains. The ultimate hypothesis of reality, however, cannot differ for different sciences, but must include both the diversity and the continuity aspects, both the atomic and the fluid hypothesis. An attempt to form such an hypothesis is the vortex theory of Lord Kelvin and the squirt theory of Karl Pearson. However unserviceable these theories may be in their present form, they aim at any rate at a concrete statement of reality as a habit-forming time reality.

If it is asked then if time is continuous, we must answer that inasmuch as the continuum presupposes the negative property of time, time as such cannot be spoken of as a continuum. Again, to the question how many continua there are we would answer that ultimately the historic continuum is the type of all continua. Spatial continuity, too, must ultimately be derived from process or history.

F. *Time and Causality*.

The close relation between time and causality is recognized by all great modern writers. The boundaries, however, have so far been imperfectly defined. Are the two identical or reducible at least into terms of each other?

There has been great difficulty in the past in keeping the causal category distinct from other concepts in which it tends to merge. This is not an accident, but is due to logical implications. Among the concepts involved are especially time, substance, necessity, chance, sufficient reason, reciprocity, freedom and individuality. It is not our purpose here to unravel all these interrelations, though perhaps this brief analysis may simplify the case somewhat.

Perhaps the root of the difficulty after all lies in the failure to distinguish between causality as involving real process and the ideal interpretation of cause and effect. Perhaps there is no concept in which the inner struggle between the ideal and the existential aspects of reality is more intense than in the concept of causality. This is shown in the very difficulty of keeping it distinct from the time concept on one hand and the concept of substance and the sufficient reason on the other.

The difficulty may perhaps be stated in the form of an antinomy:

1. Cause and effect must be distinct or different, if in nothing else at least in position, as in purely mechanical displacement. Suppose cause and effect did not differ, then nothing could have *happened* and it would be senseless to speak of cause and effect. There would simply be the same identical fact or truth. Therefore, in so far as the terms cause and effect have meaning at all, they must be different. The effect

must somehow be a new fact. There must be real process in the world.

2. Cause and effect cannot be distinct either as regards position in space or as regards the before and after, nor can they differ in any other manner. For suppose they differed in position, that namely the cause came before the effect. They would simply be two different facts. Suppose, furthermore, that they should differ in any other manner, whether qualitatively or quantitatively, in so far as the effect differs from its cause, it cannot be caused by it, and we have been mistaken in regarding it as cause. Therefore in every respect cause and effect must be identical.

The second part of the antinomy is the only one that is likely to satisfy the mind for which mechanical simplicity or logical unity is the ultimate category. Here at least mathematical mechanics and absolute idealism, monistic materialism and monistic spiritualism join hands.

Mechanics tries to resolve everything into equations of masses in space. Mass and position alone remain as fundamental. The before and after are dismissed as irrelevant. Given the position of any particle (according to Clifford) and the whole infinite past and future must be determinable from that. Knowledge must be knowledge of relations. "As it was in the beginning is now and ever shall be, world without end. Amen." That the mechanical account is not adequate to the real character of the world is acknowledged by no one more candidly than by Clifford, Taite, LaGrange and other physicists. Just because the mechanical theory takes account only of now relations, its account is valid only with reference to an abstract stereotyped now. For moving reality we have the instantaneous conceptual photograph. The real process, on the other hand involves a series of nows, different strata of being outside of which the equations talk nonsense. The great physicists, therefore, now realize the difficulty of making conceptual shorthand do service for real process by all sorts of figures of speech, though of course, insofar as we have a science of mechanics, it must be based upon identity of relation, and causality for it must be translated into terms of the law of conservation of energy and spatial reciprocity.

Perhaps the law of gravitation furnishes the most perfect example of the modern attempt to merge the category of causality into that of reciprocity. Ever since Newton's time equations have done the service of explanation. Determination of masses and distances seems to have made time and causality in the old sense superfluous. Reciprocal relations are everything. But here, too, the inadequacy to explain real relations has been recognized by the physicists. Even if the physicists for the present must be satisfied with such equations, it is not because they are satisfactory. The various theories, such as the famous vortex theory of Lord Kelvin, the squirt theory of Karl Pearson, etc., are attempts after all to substitute a causal or dynamic explanation, however complex and difficult to accomplish, for mere static equations of reciprocity.

Nor can we get rid of the difficulty by trying to reduce the category of cause to the category of substance as in the modern idea of transmissive function as opposed to productive function. The various substances of science are regarded as related to each other as condition or occasion. The match is the occasion of the explosion of the gun-powder. One rearrangement of atoms is the occasion for another rearrangement. This in our ignorance of real relations may be a convenient way of speaking, but it can hardly be regarded as a solution of the difficulty. Old fashioned philosophic occasionalism at least recognized the miracle. Nothing short of preëstablished harmony could make occasionalism workable, whether in the relation of mind and body, or in the interaction of material substances. This simply shows, however, how the old category of real causality breaks out in spite of all our abstract working tools, yea rather because of them, in that they furnish us with certain limits with reference to which we can measure the flux of the world.

If in mechanics the category of causality has had such a hard time to hold its own against such static concepts as the conservation of energy and reciprocity, as expressed in terms of mass and position, still more danger has it suffered from the idealistic attempt to merge it in the concept of sufficient reason. Bosanquet expresses the general sentiment of the absolutist idealists when he says that causality is an imperfect category, one which demands completion and when completed becomes lost in the sufficient reason. The relation of antecedence and consequence must give place to explanation by inner connection or position within a system of significance.

Thus according to idealism, causality forms a sort of unstable middle ground between mere time-sequence on one hand and explanation within a purposive whole or system on the other hand. In causality we have more than sequence, we have at least external determination, which, however, to become significant must give way to inner connection. The real world is one significant, complete whole, in which there can no longer be any successive or external determination, but each fact is seen to be the individual embodiment of a purpose. Succession and causality are due to our finitude in apprehending the complete experience. Hence the real world does not acknowledge them. That the real world must be known *sub specie æternitatis* is common to Spinoza's substance and Hegel's absolute. In either case inner necessity or connection has appropriated antecedence and consequence. Does this afford a final solution?

Here no more than in the case of mechanical reciprocity does the solution meet the demands of the real world. Of course just in so far as we aim at logically satisfactory explanation must we aim at just such a closed system as the one absolute idealism proposes. The question is: Does the real world permit of such a closed system? Can time be so completely excluded? Our whole discussion of the time concept shows this relativity of our system of significance with reference to the time process. What, then, must be our final answer as regards the relation of the categories of time, causality and sufficient reason and what solution can be offered to the antinomy with which we started?

First, then, what is the distinction between time and causality? We cannot agree with Kant that some time-sequences are not causal. If you take his illustration of the perception of the flow of the stream and the perception of the parts of a house, it is evident that Kant has mixed his causal series. If you take the point of view of the spectator in both cases the distinction will vanish. The series of perceptions in either case can no doubt be reduced for psychological purposes into a causal order.

If you again look at the objective side, the house for dynamic science is only a more complex causal nexus than the stream. But neither can we on that account take the position, which seems to have been taken by Schopenhauer, that the two categories are, therefore, ultimately identical. The concept of causality involves besides more or less explicitly, as Sigwart points out, the idea of connection. It implies that absolute chance does not rule to such an extent that there can be no uniformity or verification of expectancy. Causality, therefore, implies the concept of habit as well as that of chance or time. Not habit merely on the part of the observer as Hume would have us believe, but such habit or uniformity on the part of nature as realizes expectancy. And here is where the tug of war begins. Make uniformity or law absolute and the time element vanishes. Causality becomes lost in mechanical reciprocity or ideal system. Such absolute uniformity, however, would make consciousness, which has evolved in response to the need for adjustment to the ever growing complexity of its environment, impossible. If again you emphasize the chance or time aspect, you make any uniformity, law or necessary connection impossible. Hence causality has again disappeared.

Causality, therefore, is a complex category and has reference at the same time to the process aspect of experience and to the uniformity or truth aspect. It is light enough to enable approximate adjustment to the growing environment, but dark enough to prevent the reduction of experience into a transparent system of ideal significance. Its uniformity is only a relative uniformity, except when it is hypostatized as a logical abstraction, when it must be treated as are all convenient relative abstractions.

Causality, then, marks the struggle of the self to synthesize or unify the process of experience. It succeeds in this attempt at unification only at the expense of ignoring the very process aspect of experience which it *means* to explain. Causality thus ceases to be real causality and becomes a timeless category, but the inadequacy of this category to cope with concrete experience, grows everywhere apparent. Causality to the end *means* to deal with real process; and, as long as the universe remains a universe of process, the 'imperfection' of antecedence and consequence, of change and expectancy, must be a necessary part of the meaning of causality. When chronology vanishes into the determination of logical system, then and not till then will causality become superfluous.

When causality is viewed from within, becomes conscious in a self directing individual of a purpose which it aims to realize, we call it will. Here again the old struggle between law and uniformity, on the one hand, and chance and the time element on the other, breaks out afresh in the problem of the relation of character (habit or uniformity) to self-determination or freedom (chance or time).

G. *Time, Chance and Necessity.*

In the preceding discussion we have sometimes used time and chance as interchangeable terms. This makes it necessary to say a word about chance and its relation to necessity.

Chance is sometimes used to indicate a subjective attitude of ignorance, when the facts themselves are regarded as determined. In cases where we apply calculations of probability we are ignorant namely of part of the facts or connections, and this makes it impossible to anticipate or state with certainty the behavior of any one fact within the system. We, therefore, make a disjunction of possibilities with reference to such knowledge as we possess. As chance in this case is only a name for ignorance and has nothing to do with facts, conceived as objective, we may pass it by.

Chance again is sometimes used in regard to matters of fact as opposed to necessary connection between facts. That the universe is this individual universe and no other, that it has just this variety of qualities cannot be accounted for, but must be accepted. In neither of the above cases, however, does chance have anything to do with the time problem.

But there is a more real meaning of the term, and that is where chance is identified with change or process. Where we are the most familiar with the problem of chance is in human volition. If it is possible for a human being to decide otherwise than he does, then here at least we are confronted with a reality which cannot *now* be definitely determined and in regard to which disjunctive judgments at most are possible, no matter from whose point of view. Human freedom is one case at least where we become acquainted with chance.

Real or ultimate chance, therefore, means absolute novelty in the universe, whether in the realm of nature processes or in conscious willing. Wherever there is real process, where events happen, there we have chance. Time and chance used in this ultimate sense are identical. Time has already been defined as that element in reality, which makes all our descriptions relative; and that is precisely what we mean, in the last analysis, by chance.

But what, then, is necessity? Is it true, then, that chance is objective and necessity subjective or vice versa? Neither is true. Both are subjective meanings and both must have their basis in social experience. Necessity pertains to the facts of experience, in as far as they can be systematized. Now in order for the facts to be systematizable there must be uniformities in experience. There must be agreement, too, in the unifying activity of various individual consciousnesses, *i. e.*, there must be social unity. In so far only as there are social uniformities does necessity have an objective basis. In so far, again, as these social uniformities are after all dependent upon individual processes and are mere abstractions apart from these, — in so far must necessity be limited by chance.

Causality thus affords a synthesis of chance and necessity. In so far as causality has reference to that aspect of experience which makes continuity of structure and, therefore, uniformity or predictability within the process of experience possible, it partakes of the category of necessity. Because our world is a habit forming world, each moment of experience must involve a certain identity with preceding moments, making possible retentiveness, associations and concepts. Each moment, then, will be seen to be an outgrowth of its past, whatever the changes or chances may have been in the making. These expectancies are construed into systems, an ideal network, in the meshes of which we strive to catch the processes of nature. Only that this network is not ready made, but is an outgrowth of the adjustment of a conscious organism to an environment upon which it is dependent for the satisfaction of its needs. It may be, however, that tendencies or physiological dispositions are established as a result of race experience which, as the nervous system matures in the individual, facilitate such a taking account of uniformities, even though these dispositions cannot be regarded as innate ideas, or even innate feelings.

On the other hand our knowledge of the world, whether in the form of the chaotic predictions of common sense or the more systematic predictions of science, is always limited by the other aspect of experience, namely, that it always is in the making, that our predictions must be readjusted. Absolute uniformity on the part of the individual consciousness is acknowledged by all to be out of the question. Finite consciousness is admitted by even the Hegelians to be a process, and inasmuch as the most important part of the world, to which we must adjust ourselves, the only part we can be said to really know is made up of individual consciousnesses, we at any rate must always find our knowledge limited by process and chance.

From what has been said it is evident that we cannot speak of *a priori* necessity or *a priori* law or uniformity. Necessity pertains to the world as *made*, not to the world in the *making*. It would be more proper, therefore, to speak of an *a posteriori* necessity than an *a priori*. It is only as we abstract from process, from causality out of the future, to use Professor Palmer's phrase, that we can apply those categories of identity, which the self in its social relations has found so useful in describing its world and formulating common plans of action. Real process or real futurity lie alike outside the field of scientific description. Necessity is the result of the projection of present demands or ideals into the world of experience,— demands for unity and wholeness which are alike essential for any meaning or knowledge, and alike unrealizable in a world where real time or chance is a factor. This continuous readjustment of a changing self to a changing environment seems, however, indispensable to self-consciousness; and absolute logical unity or necessity, if reached, would prove suicidal to the very ego that posited it as a limit in the interest of the ongoing of its own activity.

CONCLUSION.

Utterly as the serial view of time fails to furnish a definition of the real time character, it yet contains many interesting suggestions. The time character is, however, bound up with the coming and going of contents, with their appearance and dying away. This relative duration character or, what would be more to the point, this relative change character of contents, this transitory character of the mental life, is indeed what gives us our perceptual datum of a time world. But for logical analysis this is obviously not a simple character. The relative duration or relative fleetingness implies two antithetic tendencies on the part of reality. If we express this simplest fact of perception as relative duration, this implies that the duration or habit character is limited by another, a negative character, which is continually creeping into the former and eating away its hold. On the other hand, if we say relative fleetingness this points to the fact that the negative aspect is limited by a positive, which makes possible a world of cumulative significance, makes each dying moment die gradually, instead of being extinguished at once, and thus sing its swan song to the rising moment. Where the mistake has been made has been in failing to distinguish this dual aspect, this time and anti-time aspect, of the simplest possible concrete experience and treating that which is perceptually simple as also conceptually simple. Conceptual analysis alone can discover those ultimate characters which shall make a consistent description of our perceptual world possible. Any half way analysis must ultimately land us in hopeless contradictions.

If we are to define time, moreover, we must take care that time does not get lost in its contradictory or not-time. This must be the result if we attempt to define time as series. In a series the positions must exist *simul*. The positions, that have vanished or are not yet, obviously can be no part of the series. But it is precisely with this vanishing and coming, in relation to an attending subject, that we connect the idea of time. A world in which all the positions should coexist invariably to the fixed gaze of attention would indeed be our conception of a timeless world. Time, so far from being itself explicable as a series, is that character which belies or makes relative all series or static descriptions, when these attempt to be exhaustive of concrete experience. Series, then, cannot be made the *ratio essendi* of time without losing time in its contradictory.

Series, moreover, presupposes, as we have seen, the time character as part of its *ratio fiendi*. It presupposes time and diversity of habit for its arising, and shows through and through its relativity to these characters. It is the time character which alters the value of the positions in the series and thus makes our task of describing reality an infinite one, *i. e.*, makes all our descriptions relative. This derivative character appears in all our series concepts. Whereas number, for example, as an existent series, as a graded scale of significance, is timeless, yet numbers can only arise through counting, through the reflective attention process of a subject, each step crystallizing into significance and accumulating into the next. It is time, negating each step as such and giving rise to a new one, that gives us the individuality of number and the crystallized scale of values. Such an accumulative order could only arise as the result of a time process. Space, likewise, shows its dependence upon time, as except for each position passing into the others we could have no continuous space. The infinite finally is nothing but the abstracting of the relativity of our experience as time activity. While series, therefore, as existing significance is timeless, it shows through and through its abstractness and its dependence upon the time character for its becoming.

If series, however, cannot be made the *ratio essendi* of time, it is evidently its *ratio cognoscendi*. The negative or fleeting character of time could not be discovered except with reference to a relatively stable system of meanings. It is because our serial description proves relative that we are forced to take account of the negative character, which falsifies all our descriptions. It is serial construction which makes possible a graded scale of values and therefore measurement; and it is with reference to our relatively stable quantitative standards that we can ascertain the fleetingness of our own subjective processes.

In concluding the present discussion, however, I wish to add that in showing thus the relation between the concept of time and the concept of series, I have touched the root of the difficulty as regards the time concept. Make the concept of series prior to the concept of time, as philosophers have agreed in doing up to date, and it becomes impossible to define either time or series without a hopeless circle. Make series again derivative or secondary and the hitherto baffling paradoxes of Zeno vanish. If time is taken as a series, then even an infinity of positions would not alter Zeno's difficulty as to the definition of the flying arrow. For if time is an infinity of coexisting positions then the arrow would have to be at an infinite number of positions at once, which is contradictory. The problem of continuity, moreover, would still remain. Since even an infinite number of points could not give you a continuous line, how could the arrow get from one position in time to another? It could never begin to move. If the serial positions, however, are *a posteriori* abstractions, our ideal construction, the pictorial habits of our brain, they will not interfere with the flight of the arrow. It becomes obligatory no longer upon the arrow to pass from one static point to another in our conceptual system, but upon our conceptual system to discover its relativity, its inadequacy as static to exhaust the perceptual world.

But Zeno himself and all the rest, who have inherited his abstractions, have presupposed time in our sense in order to make their abstractions mean anything to them. Process is prior to ideal construction and our ideal divisions of process do not affect the real nature of process. An infinitesimal rate of motion is still motion. On the other hand, no infinities of static positions of however many *Mächtigkeiten* can give us process. Our ideal divisions and serial constructions are facts of a different order from the going on of process. They may symbolize process to us, but they cannot constitute process. They remain to the end derivatives of process, whereas time is the dynamic element in process itself.

The antinomy, as to whether time is finite or infinite, vanishes equally, when we once recognize that time is prior to serial construction. The concepts finite and infinite have meaning only within the world of ideal construction. Neither has anything to do with facts as facts, with the *given*. Whether ideal construction is regarded as finite or infinite depends entirely upon the limits which the active time subject sets itself. If its purpose is belief and action, its construction is finite, limited by all the real conditions of a changing and a pluralistic world. If its purpose is merely free construction, the free play of the idea, it can construct infinities to suit itself. The historic series indeed can be regarded as an infinite series of changes, a real infinite; but it is regarded thus, not because time is serial, but because time is a character of reality, pertains to the ultimate constitution of our world; and this constitution remaining what it is, we cannot conceive of the world as otherwise than changing, *i. e.*, we can conceive no end to history in the abstract, though our own purposes are finite and limited. Explanation has nothing to do with beginnings or first causes, but with constitutions, with operating conditions. We are not concerned, like the ancients, with creating a world, but with finding out its nature.

We must agree, therefore, with Kant that ideal construction presupposes time as a datum; the time flow must be conceptualized or interpreted into a system of meanings. Again, it is because of the relativity of the system of meanings that the time character itself is ascertained. Hence from the point of view of knowledge the ideal system is prior, though from the point of view of belief time is prior. As against Kant we have pointed out that series and order themselves involve ideal construction and hence presuppose time as a datum. What remains as the ultimate time character is pure negativity, not non-being as an empty ideal abstraction, indistinguishable from equally abstract being, as with Hegel; nor relative non-being in the sense of mere otherness, other being; but non-being as an ultimate aspect of reality, a dynamic principle, negating the habit structure of the world and transforming it into ever new structures.

CHAPTER III.

TIME AND BEING — A SURVEY OF ATTITUDES.

A. *The Timeless.*

In order to understand better the function, which time fills in experience we will begin by abstracting from time and regarding reality as a timeless system of truth. Such a world is of course for us as time-subjects a mere hypothetical abstraction. All we can do is to abstract from our time-experience as we have it, and conceive it as it would be with time eliminated, given for the time being our distinctions as arisen by virtue of the time-process.

Such a world would be a world of abstract dialectic, such indeed as McTaggart conceives the Hegelian world to be; a dialectic silent as the dance of the deaf; a dialectic without movement or variation of attention, for ideal motion, Trendelenberg to the contrary, is a contradiction in terms; a timeless viewing, where all the stages or ideal moments exist for consciousness at once, and have their fixed setting in an ideal scheme, where reality is included and exhausted in one self-complete and infinite definition, the Idè, the Absolute.

If we have recovered our breath, after speaking such magic and potent words, let us see what place certain categories would have in such a world. The concepts that would have to be retranslated especially in such a world are the dynamic concepts. Take for example the concept of motion. Just think of defining motion as an infinite number of intermediary positions existing 'simul' for a subject. While you may thus shirk Zeno's problem as to where a body is when it passes from one position to another or how positions can be made continuous, by denying any passing whatsoever, you raise a still more serious problem as to how a body can be in an infinite number of positions at once. In other words such concepts as motion or change would be meaningless in such a world.

Causality in such a world would have to be translated into terms of sufficient reason or logical system. Cause and effect would be identical and both terms would have to be dropped out of the vocabulary as superfluous.

Attention, in such a world, could be merely the convergence of an ideal system, would have to be expressed in terms of significance. It would be the complete meaning or the consciousness of the whole of itself. Variation of attention would of course have to be ruled out. That the qualitative discrimination, assumed in such a world, presupposes variation of attention and, therefore, time is ignored by the advocates of the static view. We, the abstracting time-subjects, have these contents present to us, and, therefore, can make a timeless synthesis of them.

Activity in such a world would have to be translated, as Spinoza does, into adequate ideas or complete logical definition. Possibility or impossibility would, of course, be equally meaningless, where there can be no creation out of a contingent future.

Past and future in such a world would become mere attitudes on the part of a willing subject. But the meaning has dropped out of both of them, they are mere words, ‘sounding brass and tinkling cymbal.’ What could the attitudes of pastness and expectancy mean, where nothing happens ?

Non-being in such a world could only mean that one fact or form of being is not another, and the assertion of identity could hardly be made when no question or doubt is possible. It is the seeming flux of things that makes us demand identity. To be honest at all in such a world we should have to eliminate at least a good deal of our vocabulary and the corresponding concepts and judgments.

When, however, we keep in mind that the icy grandeur of this static fabric is the result of our own abstraction and ideal construction, there can be no danger of being led astray. It is, on the contrary, altogether proper to try the logical experiment of elimination for the purpose of discovering the value and interrelation of our concepts. Abstracting certain concepts from concrete experience only keeps them in abeyance (*aufheben*), it does not destroy them. We have all the while in the background the inner wealth of concrete meaning, which gives value to our abstractions.

If, however, we take our timeless construction seriously, if we hypostatize it into a world, as so many philosophers have done, we shall land in hopeless contradictions. In a really timeless world, in a world of no activity and no process, there would not only be no dynamic judgments, but no judgments at all. As far as we know at any rate the arising and development of consciousness would be impossible except for the ever present necessity of adjustment on the part of the organism to a complex and changing environment, in order to realize its needs. Concepts are developed as tools by means of which we may be able to seize upon the relatively permanent in the fleeting changes of things and thus anticipate the future. The psychic content becomes detached from the perception, because the perception has disappeared, and the psychic content thus torn loose becomes symbolic for the reflective subject of all similar situations. Without time process, therefore, we should have no meaning, no judgments; we should have simply the glassy stare of the mystic one, which again is nothing except for our choosing to posit it.

All description indeed must be abstract and timeless. Description too is necessary for the highest possible coördination and adjustment. Without description, social coöperation would be well nigh impossible. There are two dangers, however, that we must guard against.

One danger is that of being satisfied with an incomplete and provisional description. While description is not reality, it should furnish us with symbolic equivalents for reality. The timeless description above has made absurd the facts it was invented to make intelligible. But a description which lands us in hopeless contradictions is obviously a failure. We must look again for the elements which we have missed. We must have faith that the universe is amenable, at least, to consistency; and seeming contradiction must be a challenge to us to revive and complete our ideal network of symbols.

A second danger lies in the tendency to hypostatize our description as reality. This has been the danger alike of idealism and realism in the past. Democritus hypostatized his hypothetical atoms, and Herbart his qualities, no less than Plato his impersonal ideas and Hegel his Absolute. We must not forget that reality at heart is individual and that, however far we may carry our conceptual analysis and synthesis, it can never exhaust the 'acknowledgment' of unitary wholes which only will and appreciation can create for us. This individual core of being must always remain a limit toward which description approximates, but which it does not reach. The conceptual function, in other words, must regard itself as the instrument by means of which the willing and appreciative self strives to become conscious of itself and to realize itself. It is not an end in itself.

The real is the finite, the fleeting and perishable, the permanent is the shadow or symbol.

> This is but his shadow,
> His substance is not here,

may be said of all our ideal abstractions. This means a reversal of the idealistic emphasis from Plato down. Instead of

> Alles Vergänglicher
> Ist nur ein Gleichness,

I would say that the eternal or conceptual is only a poor copy or symbol of real life.

> Grau, teurer Freund, ist alle Theorie,
> Und grün des Lebens goldner Baum.

With this introduction it devolves upon us now to seek for the missing element, which may free our above description of reality from its contradictoriness. If it will not do to eliminate time, what function does time play in reality? In order to get the problem before us we shall examine

B. *Some Metaphysical Attitudes in Regard to Time.*

In doing this we shall not try to be exhaustive. That would involve writing a history of philosophy. We shall select them and group them as may seem helpful for the understanding of our problem.

1. *Time as Illusion or Mere Appearance.* — Let us begin with the attitude which makes a sharp separation between the time world and the timeless, the latter always being conceived as the real. This view affords no place for history and does not attempt to give any significance to process. The timeless conceptual world *is*, the world of process and change is not, is degraded to mere appearance or illusion.

Vedantism recognizes only the reality of Brahm, the one changeless, indivisible, unnameable. All change and multiplicity belong to the world of Maya or ignorance. To attain reality we must lose self-consciousness in mystic ecstacy or hypnotic sleep. Vedantism is consistent at any rate in so far as, in denying process and multiplicity, it also denies judgment and ideas as possible from the point of view of the real.

But we find this sharp contrast also in various western systems of philosophy, both realistic and idealistic. Perhaps it is first brought into sharp relief in the naïve materialism of Parmenides. Only being is. Non-being is not. Being is one and identical. Here the demand for identity is first made an ontological principle. Process and change have no reality. They seem, however, to have reality to the vulgar and uninitiated, and for the benefit of those, who live in the world of opinion, the followers of Hereacleitus for example, Parmenides adds the second part of his famous poem.

Zeno, Parmenides' brilliant pupil, by means of his ingenious paradoxes, makes short work of the current notion of an ontological, serial time. The serial idea of time we have discussed already sufficiently. Suffice it here to say that if time were serial, Zeno would be right that it could not be real, and all attempts to answer him on his own ground have proved futile. Because Zeno's definition of time makes time contradictory, he draws the conclusion that, therefore, time and process can have no reality.

Plato, in the Parmenides especially, adopts Zeno's weapons. Thus if serial time were objective, the world could be proven both older and younger than itself, etc. The most characteristic note in Plato, as we find it especially in the seventh book of the Republic and in the Symposium, is that the world of process and change is a world of shadows. The reason must rise above the flux of the world of perception and feeling to grasp laws and institutions, and only as finally, through dialectic, it beholds the eternal ideas of truth, beauty and goodness has it arrived at the real essence of things.

In Spinoza's Ethics we meet the same sharp separation between the time-world and the real world. Time, as the sense of duration, pertains to the modal aspect of the world; and therefore, things, in so far as they involve duration, have only an indefinite existence and our ideas of them are confused. In so far as we come to have adequate ideas of things, we see that they are necessitated by the constitution of the infinite substance, by their place within the eternal system of things. What the relation is of the infinite mode of motion to this eternal point of view, Spinoza does not try to show, but evidently the former is a concession again to the confused and partial world of opinion.

With Kant the subjective character of the serial time notion with which he deals comes to consciousness and influences radically his whole theory of knowledge. It is because the mind is obliged to fit its given data into its *a priori* serial forms of time and space that it is forever shut off from the world of reality. The long list of Kantians ever afterwards, whether they have regarded reality as a system of thought with Hegel, or as atomic qualities with Herbart, or will with Schopenhauer, have adopted essentially at least this formal point of view of time.

It is impossible to keep the two aspects of experience, the temporal and eternal, in two different compartments, however air-tight we try to make them. Time has a subtle way of creeping into things, even the eternal world of ideas. Calling a thing an illusion or opinion or appearance, moreover, does no longer free us from the responsibility of accounting for how an eternal, static system could produce the illusion or appearance. A universe, which should have such a capacity for lying about its character, would make one mistrust any efforts at knowledge.

What gives such plausibility to this timeless view of the world, in spite of violating all the facts of experience, is the ingenious shifting on the part of its advocates from one point of view to another. If you corner them in the world of fact, they graciously admit that the facts in the world of perception seem to be that way, that so it appears from the finite point of view, that the common herd, living in the world of opinion, knows no better; but then, instead of trying to account for appearances, by some magic trick they disappear altogether, only to reappear in a different dimension, speaking from a different point of view, in a new rôle, whether they call it Brahm or substance or the world of ideas or the absolute or reality, or whatever other name this new rôle may be given.

In the end we shall find that this account of experience has done great service by bringing into sharp relief the dual aspect of the world as a world of process and activity on one hand and a world of truth on the other. They are right, too, in maintaining that the conceptual aspect is the eternal and permanent aspect. That the multiplicity of fact and the fleetingness of process can somehow, approximately at least and for purposes of expectancy, be reduced to concepts of unity and substance, has been the inspiration of science, which always has a strong tendency toward Platonism, to regard namely its symbolic generalizations or conceptual shorthand as the essence of things. The atoms of the chemist and the ether of the physicist are apt to seem to them far more real than the perceptual facts which they are invented to explain.

But the Platonists, while emphasizing the importance of the conceptual aspect, have been and will always be wrong in denying the reality of process. While science may have no use for process except in so far as it can be reduced to static categories, yet *a posteriori* the time aspect will always make itself felt and make ridiculous the eternal dogmatism and security of the theorist. It is because truth is not independent of process, but is ever striving to symbolize activity and life, that we have that *negativität*, which makes ever larger insight possible. The *negativität* of truth, in other words, is not to be sought in truth as such, but in relation to the demands of a developing self.

2. *Time Derived from the Timeless, a 'Reproduction' or 'Copy' of the Timeless.* — Let us next take up the attitude

which, while it still emphasizes the reality of the eternal, strives, however, to give some significance to process or history in relation to the eternal consciousness. With the strong emphasis that Hindu thought always places on the eternal and timeless character of reality, two of their greatest systems have been forced to give some, though a grudging recognition to the significance of history. Thus the realistic Sankya system, while its ultimate reality is a timeless plurality of self-conscious souls, still admits a secondary principle, Prakriti, the world of process or matter, as the necessary condition of the soul's becoming self-conscious. It is only by reacting upon Prakriti that the soul awakes from its sleep and rises through the various stages of development. When the soul becomes conscious of itself, Prakriti like a timid maiden withdraws, never to appear again. Thus Prakriti becomes a model of modesty and disinterestedness, giving everything, yet claiming nothing, which would be more credit to Prakriti, if its existence did not vanish in the light of knowledge. How nothing at all could furnish the possibility of development and the realization of the ideal of self-consciousness is difficult to understand.

Even Buddhism, in spite of its condemnation of becoming as an illusion arising from ignorance and desire, and while its ultimate goal is the negation of desire and process, a bliss which from the point of view of time existence is indistinguishable from nothing at all, still makes ethical process the path by means of which Nirvana must be attained. The bliss of inactivity must be attained by disinterested activity, the enlightenment that multiplicity and change are illusion can only come through a long series of existences of suffering, in which the Karma or character acquired in previous existences, conditions the form of the new rebirth, until finally as a result of the enlightenment and expiation of this process, the truth of the illusion of all process and existence makes the soul free and at rest.

Plato, in spite of his sharp distinction between the time world and the eternal ideas and his scorn of the former, cannot help recognizing it in various ways. I do not refer to the *Timaeus*, where he speaks of time as the image of the eternal, for here he has in mind the measure of time, especially the regular movement of the heavenly bodies, which in their very regularity and periodicity are for Plato symbolic of the rest of the eternal. Here Plato has simply abstracted from the essence of time altogether. I have reference to the grudging recognition of the world of process, the Heracleitean flux, which is wrung from Plato in various ways.

Thus Plato recognizes the reality of the world of process by the resistance it offers to the mirroring of the ideal; ὕλη is not mere passivity, it distorts and resists the ideas. This resistance, as pictured for example in the *Phædrus*, gives special significance to the ethical struggle. Only through a long struggle, through repeated curbing, failure and chastisement, does the unruly steed of appetite become amenable to the control of reason, and make possible the rest and rapture of the contemplation of the eternal beauty. Here, then, process and time are at any rate recognized as means to the eternal end.

But the whole process of education, whether outlined pedagogically as in the *Republic* or poetically as in the *Symposium*, involves and presupposes the reality of process. There is a necessary order of educational steps, whether it be described in terms of institutional adjustment, as the use of tools important for the education of all, music and gymnastic for those surviving in the process of selection, and divine dialectic for a chosen few in their maturer years; or the æsthetic ascent of the soul in the *Symposium* from the love of one fair form to the love of all fair forms, from fair forms to fair actions, from these to science and institutions, and from these to the eternal ideas. This order, moreover, corresponds with stages of psychological development. Heracleitean process, contradictory and unreal though it is supposed to be, is at least the path by means of which the soul reaches its insight into Parmenidean being.

To be sure in some moods Plato is inclined to condemn process altogether. Thus in the *Phædo* process itself seems to be an evil, plunges the soul into the darkness of ignorance and the forgetfulness of sleep. The process of recollection itself leaves us at any rate no better off than we were at the outset. History here loses all real significance.

A great deal has been made by students of Plato recently of what seems to them a dynamic or functional view of reality, especially in the *Republic*. Plato does indeed use language there, which has a strong functional flavor. When, in the fourth book of the *Republic*, he tells us that men make the state in accordance with their needs, this indeed sounds dynamic. But to regard the provisional definition given in the fourth book as Plato's definition of the state would be as reasonable as to regard the definition of justice given in the first book as Plato's definition. In the seventh book, where Plato is in a position to give us his philosophic definition, the real state is looked upon as an eternal idea. Our making of states is a poor imitation at best of the heavenly pattern, which of course is unaffected by our efforts. The real statesman is the philosopher, who through dialectic has become conscious of the perfect state, and who through his experience with men in the world of shadows knows how to adapt the ideal state to actual conditions. But even the work of the philosophic statesman is not ultimately productive. He merely imitates what is, as conditions will permit.

A keener sense of the reality of process, and even a conscious recognition of the significance of history, is to be found in Plato's great successor on the philosophic stage. There are for our purposes two rather distinct Aristotles: Aristotle dominated after all by the Platonic ideas, who means to make process significant and fails, and Aristotle, the empiricist, who has given us some potent suggestions toward a system of real dynamism. It is the distinction, which comes out so strongly in his *Nichomachean Ethics*, between Aristotle the intellectualist, who espoused the virtues of contemplation as supreme, and Aristotle the practical man and statesman.

We shall first take a glance at the traditional Aristotle and his traditional categories, the potential and the actual. It is perhaps fair to say that these famous categories have led to more verbiage, more hood winking with truth and logical juggling than any other categories ever invented. They are so thoroughly superficial and so obscurely plausible. The only excuse for paying them any attention is that they still dominate largely our thinking.

No category is more confused and indistinct, when you begin to think about it, than the potential. Aristotle himself is difficult enough to make out. Thus he uses the term ὕλη, matter, which somehow must be at the basis of process, as truth knows no process, in at least four different senses.

1. As mere privation or negation, mere passivity, the feminine as opposed to the masculine principle.

2. As evil, the source of counter workings, accidents and incompleteness. These two uses Aristotle has in common with Plato. They indicate an essentially static view of reality and give no real recognition to process.

3. As substance or substrate, the basis of individuality and perception.

4. As a lower stage contrasted with a higher. In this matter loses its foreignness in the light of the transformation. The latter two uses are typically Aristotelian.

These positions for our purpose may be reduced to two: First, ὕλη as external or foreign to the actual or the entelechy; second, ὕλη as a lower stage, as being matter or form according to the point of view.

If matter, in the first place, is something foreign to the actual, another kind of existence opposed to it, then we have an irreconcilable dualism. No τρίτος ἄνθρωπος could be found, which could relate them, for the relation would somehow have to partake of the existence of both terms; and hence would fall asunder, by its own contradictoriness, *ad infinitum*. Aristotle himself has sufficiently exposed such contradictions in the case of Platonic ideas, Pythagorean numbers and Democritean atoms. This reduces us, therefore, to the second alternative, which seems more truly to represent the common sense of Aristotle.

We must regard matter and form, then, as relative conceptions. This relativity, moreover, is not merely subjective, but objective. It would not help us any merely to translate the old ontological dualism into subjective points of view. Points of view are just as stubborn as are objective facts. Moreover such subjectivism would be foreign to Aristotle.

If matter and form, the potential and the actual, are objective categories, the question arises as to the relation between them. They must somehow be continuous and involve some identity, if Heracleitus and Parmenides are to be reconciled. Let us see what that means.

The potential and the actual must not be altogether identical, for then it would be superfluous to have two terms for them. Process would vanish, and we should be back in the Being of Parmenides. Nor could they be partly identical and partly different, for then in so far as they are identical the distinction of potential and actual would vanish; in so far again as they are different we should have our old irreconcilable dualism.

It seems impossible, then, for the potential and the actual to coexist in the same universe. We should have to side with the Megarians, as against Aristotle, that only the actual is. The potential is not an ontological fact at any rate. The acorn is an acorn, and the oak is an oak. The acorn is not a miniature oak, it is not an oak at all. When the oak seedling occupies the space of the acorn, the acorn has disappeared. If we want to explain the transformation of the acorn, we must do so in terms of chemical changes actually going on. Science is right in discarding teleological categories for purposes of explanation.

To be sure, as a result of chemical changes, we find that nature repeats certain successive forms; and, because of this uniformity of nature, we are justified in expecting the same result, given the same conditions. But it would be absurd to say that our subjective attitudes of expectancy or our inner purposes constitute the process or explain the successive transformations.

There can be no doubt that for Aristotle the potential and the actual coexisted; the end or τέλος is in the beginning; the later stages, somehow, in the eternal world, coexist with the earlier in history. The 'unmoved mover' is both the efficient and the final cause of the universe. Sometimes, as in the *Physics*, he is conceived as giving the world a push from outside, in other places he is conceived as drawing the world to himself by the enjoyment of the simple pleasure of the contemplation of his own complete unity. But he remains, somehow, external to and coexistent with the ongoing of process, and if process is to be explained at all, it would seem that it must be explained independently of Aristotle's God. The ultimately final cause does not act upon the world, does not influence process in any way, and hence does not really explain process.

Aristotle confuses a psychological attitude or a subjective construction with ontological fact, and hence the contradictoriness of his results. His successors have followed suit. Sometimes they have accepted his results and put on a wise look in pretending to explain process in terms of the implicit and explicit, etc., and have found enough stupid people to accept their pretentions. Sometimes, like Bradley and others, they have traded on the contradictions of Aristotle's confusion of terms and, presupposing the ontological character of both categories, have tried to make all process and history absurd.

Aristotle, himself, with his keen sense for fact did not seem to feel satisfied with these categories. The *entelechy* does not really do anything to process. God, the final and simple truth, does not influence history. The rationale of process must therefore be found within process itself. The soul develops because of its own inner yearning, its own demands for completeness. In his *Ethics*, Aristotle shows again and again that insight can only come through practice. It is, as through actual doing we establish habits of conduct, that we are enabled to see or fail to see according to the nature of our conduct. As good conduct, however, tends to welfare and happiness, we are assured of progress. Activity or adjustment, then, conditions insight or truth.

In his logical treatment of the judgment, again, Aristotle showed that there could be no judgments of the future, as judgments relate to a present constitution of things. The future is now non-being and has its own character to develop, which cannot now in its real futurity be predicted. Had Aristotle developed this tack of his philosophy, there would have been very little for present day philosophy to do. We have at any rate in Aristotle the suggestions toward an absolute dynamism. Such a dynamism, however, involves a new definition of Aristotle's concepts both in the *Physics* and *Metaphysics*.

The philosophical and scientific conceptions of process, both in mediæval and modern times, have been largely reverberations of the categories of the Platonizing Aristotle without his empirical insight. The *universalia ante rem* of God's mind, which give reality to things or exist *in re*, and are discovered by us *post rem*, show us in the mediæval realists the confusion which we have found in Aristotle.

Nor do we fare any better with the modern idealists with all their pretense to recognize history. The Hegelians simply juggle with Aristotle's categories. For Hegel himself, history is simply a sort of kinetoscope, where the logical categories, Being, Non-being, Becoming, etc., appear to pass in proper logical order. But that is only from our finite point of view, for the Absolute there is no shadow of turning, the universe is one complete system of truth. To be sure Hegel, as Plato and Aristotle, finds that the temporal process offers a resistance to the proper display of the categories, matter seems to contain an element of contingency. But that probably is only for us. It is all transparent to 'the master of the show.'

But not only to the Absolute, if there is an absolute consciousness distinct from ours, but to reason everywhere as it goes through the dialectic process, in the race and the individual, there is a necessity which sweeps us on from one category to another until we have completed the cycle. Sometimes it seems to be by feats of remarkable tumbling on the part of the categories themselves, by holding on to one another's tails, that they again and again land on higher levels within the hierarchy of logical completeness; sometimes, and probably more fairly to Hegel, it is because the logical system is eternally complete from the beginning, because the Absolute exists whole and undivided in all the timeless logical stages, that the absolute reason in us is swept on to the Absolute Idè. The Absolute Idè of the end, however, is in no wise different from the Absolute Idè of the beginning. While phenomenally there seems to be succession, in the real world nothing happens. The absolute experience is always complete.

Since Hegel, his lesser followers have tired us *ad nauseam* with their implicit and explicit. Are the later stages simply the earlier stages over again, or do they really add something new? If they are new and unique attitudes of mind, they evidently cannot be simply resolved into the earlier.

When logic has failed, metaphors have been substituted to confuse the thinker himself and others. Green and others like to speak of finite experience as a 'reproduction' of God's experience. Can ideas be poured from one consciousness into another like so many beads? That may have seemed plausible in the days of 'mental chemistry,' but is hardly plausible now. Such a metaphor, moreover, while it explains nothing denies all significance to history.

Recent thinkers, like Bosanquet, make the time world the logically incomplete and predict its vanishing as we attain the complete point of view. But why this seeming incompleteness? Must not that somehow be taken account of? Perhaps it is the character of the universe to be thus incomplete. Perhaps completeness after all is merely an ideal demand. With Royce, time seems to correspond to the incomplete finite will rather than intellect, but with him, too, reality or the Absolute is complete.

To be sure, science postulates such completeness. Clifford and Mach tell us that, as we come to understand the relations of things, we shall ignore velocity or the time aspect. The mathematical equations of the law of gravitation are to them the type of knowledge. If you once know the position of any particle, you can read off the infinite past and the infinite future. But mathematical equations are not explanations. The seeming time facts cannot be ruled out of court by a mere ideal demand. Besides there may be other ideal demands more fundamental, for example the ethical, for which these time facts are essential. Even Clifford recognizes that the above point of view is an abstract point of view and holds only within a now constitution of things.

At any rate let us stop juggling with points of view. The universe is either really complete, or incomplete, a logical system or activity. The question is which attitude can best meet the demands which the universe makes upon us and we upon it. We shall hold at any rate to the postulate of Hegel, which he sinned against so much, namely, that 'the real appears.' If, therefore, the universe appears to change there must be a basis for it in the real.

In Leibnitz it would seem as though time and history were fundamental in the conception of reality. Each monad develops from within, from the confused stage of being to the self-conscious or purposive stage, the will being always determined by what seems best. But, on closer scrutiny, it turns out that nothing really develops or happens. The later stages are already contained potentially in the earlier. Each monad is absolutely determined by its concept or its nature. Once knowing this concept you can predict every happening within the monad. There is spread out before you the infinite past and future, as well as the perspective of the whole present system of things. To be sure the monad is a created fact and so contingent upon the will of God, but once a fact it is determined by its concept. It is also true that inasmuch as we do not know our own concept, or what has been predetermined, we must find our own answer. But the answer we find is always given with our constitution.

There is no real conception of history, therefore, in Leibnitz's system. What really is, is the final concept. Leave out the *pre* from preëstablished and for creation substitute individual concept, and you have lost nothing out of Leibnitz's world. Every fact of the universe is what it is by virtue of the constitution of things. There is a sufficient reason for every individual shade of fact within the whole. Happening is thus a confused view, both as regards the interrelation of monads and the relation of facts within each monad, and gives way to the static concept of the completed whole. The soul atoms of Leibnitz are in the end as indifferent to history as are the extended, hard, and horrid entities of the materialist.

Sometimes, indeed, in modern philosophy the practical demand for real doing and real achievement make themselves felt. Thus Kant finds it necessary for ethical purposes to postulate immortality, for only in an infinite process can 'the moral law within' conquer the surd of impulse. To be sure this is absurdly inconsistent with the definition of time as a subjective form of perception! But Kant after all is saner than his theory. He is like the son in the parable, who told his father no and went.

Fichte, too, dominated as he is by the ethical motive, seems to imply action or real activity. It is in a process of real activity that the rational ego strives to make its own the non-ego, the irrational limit of impulse and sensation. The ego, in his *Science of Ethics*, is free not to act, free to commit suicide at any rate. But, in the *New Exposition*, he seems to abandon this view of the universe as essentially unfinished or in the making, for the view in which the universe is one complete, ethical system, in which we are merely view points.

If, in concluding this survey, we turn to the conceptions of modern science as regards activity, whether physical or psychical, we find that modern science on the whole is occasionalistic, if not altogether phenomenalistic. For productive causality and interaction, science has substituted liberative cause and parallelism. As regards physical phenomena, all we can say is: Given certain conditions, we may expect certain results. Scientific knowledge is simply a systematizing of our expectancies in regard to things. Postulating the uniformity of nature, we may suppose that in so far as the conditions repeat themselves, the results will repeat themselves. Assuming certain fundamental entities, atoms for example or chemical substances, their different groupings bring about the different results in the perceptual world. But in the meantime nothing has happened to our conceptual entities, which emerge as serenely indifferent as ever.

What is true, in regard to the relations of so called physical facts, is equally true as regards the relation of psychic to physical facts. One set of phenomena, indeed, seems to be the condition of the taking place of the other, but to regard one set as producing the other is scouted as savage superstition. It does not matter, moreover, whether we take the phenomenalistic or the substantial point of view. If we take the latter, physical substances may be conceived as merely liberating the properties of the individual soul substance or perhaps refracting the eternal light of the absolute consciousness in the world. Such a possibility has been suggested by so good a dynamist as Professor James, in his lecture, *Human Immortality*.

If we take again the phenomena of individual consciousness, activity here means for modern psychologists in general, as it meant for J. S. Mill, only predictability of what is going to happen next. Real happenings or real productivity on the part of the self is scouted by most modern psychologists.

The above attitude, when it does not become dogmatic, may indeed be taken as a wholesome confession of ignorance and a scientific protest against the ignorant dogmatism of materialism on the one hand and antiquated theological systems on the other. But, after all, it is only a confession of ignorance of the real behavior of things. To say *ignoramus* is certainly justified in view of the state of our conceptual construction. To add: *Ergo ignorabimus*, is simply presumptive dogmatism of another kind. The conceptualizing activity did not reach its end with Herbert Spencer or any one else.

Questions must, however, occur and demand recognition as to the relation between the conditions and the results, the static conceptual entities and the flux of the perceptual world. Platonizing in science must meet the same difficulties as Platonizing in philosophy. In either case, how can static conditions bring about novelty of result or any happening whatever?

This confession of ignorance is not confined to our mechanical concepts only, it is also slowly making itself known as regards more concrete concepts. The Darwinian and Spencerian notion of continuity in evolution is giving way to a greater recognition of discontinuities, which can afford advantage in the struggle for survival. This makes it possible by artificial selection to create new species sometimes in a single generation, and must have had the same effect in natural selection.

In logic we hear a great deal about the inductive leap *par excellence*, though every new inductive generalization must be regarded as a leap. Had Hegel written his logic now he might have substituted a series of leaps for his dialectic continuity. Each stage of process requires its own characteristic categories. Concepts do not contain any 'implicit' springs in themselves to leap into new categories! They are created and modified in obedience to a new reality.

The concepts of freedom and chance, which have been so obnoxious to science in the past, are coming in for scientific and philosophic recognition, within a generation, on the part of minds of the first rank, such as Professor James, Charles S.

Pierce, etc. This shows a tendency to recognize real happening as against a mere semblance of happening. What we need are new conceptual tools to work with.

3. *Time and Real Dynamism.* — It will be noticed that in all the attitudes examined, it is taken for granted that time is serial. It is this serial character of time, which makes Zeno reject time and process as contradictory; and the idealists from Plato down have accepted Zeno's conception and Zeno's result, thus emphasizing the fundamental timelessness of the real. Some philosophers, on the other hand, while accepting Zeno's concept of time as serial, have tried to maintain, in spite of Zeno's paradoxes, that such serial time must be ontological. As against such realists, we side with Kant and the Idealists that the serial aspect of time is subjective, is our construction, our form for spreading out experiences.

But we maintain further that the paradoxes of Zeno are due to confusing between the serial or formal aspect of time and the real aspect, and trying to make the former serve the demands of the latter. As against Zeno and his successors we have tried to show, in the first part of the paper, that the passing or non-being character of time is its real character, and that our serial construction of past, present, and future is secondary and presupposes the ontological non-being character.

If you endeavor, as Zeno did, to make a static timeless series answer the demands of the change character of reality, then you will have youth and old age, the birth and the funeral, coexisting. To speak of serial time as irreversible, as Kant and Fichte do, is simply a tacit denial of the serial character, and a reference to a more fundamental character. A series, in the very nature of things, must permit of starting at any point and passing backward or forward at pleasure, the passing making no difference to the series. This is recognized by Fichte in making the present a mere arbitrary starting point.

If you start with the ontological non-being character, nothing is more natural than that the ego, beside the three spatial dimensions found convenient within the 'specious present,' should project the additional dimensions, in response to its changing content, one to spread out the symbolic representations of that which is no longer, and the other to adjust itself to contents it may expect, granting the uniformity of nature. The latter itself, we shall see, while a convenient, is an ultimately relative concept.

While this character of time has been implied in human attitudes ever since man began consciously to react upon reality, yet it has never found scientific formulation in the history of philosophy. That the broken china cannot be mended, that what is done cannot be undone, are common sense maxims expressing the necessity for human beings of adjusting themselves to a world of real happenings.

These common sense maxims were emphasized and perhaps first brought to conscious reflection by Heracleitus. "We cannot bathe in the same stream twice," "Water comes from earth and soul from water, but water is death to soul and earth to water," are ways in which Heracleitus expresses his belief in the irreversibility of the real processes of things. Heracleitus, however, was not in a position to distinguish between real process and our subjective meanings which strive to express this process. The distinction between the subjective and the objective had not yet been made, and for Heracleitus the process and the *ὅδος*, the traveler and the path, the change and the 'measure,' seem to have equal reality. If in his ontological speculations he emphasizes the process or flux, in ethics he emphasizes the supremacy of the *λόγος* or 'the common' and thus becomes the father of Stoicism. Moreover, for Heracleitus process itself seems cyclical.

In modern realists, who generally speak of time as 'the sense of duration' with Descartes and Locke; or, more objectively, as 'the duration of process' with Shadworth Hodgson, we have the real time character confused with its opposite character, that of habit or duration. Modern realists, moreover, quite as much as the idealists, deal in static concepts, whether it be the substances of science or some sort of unknowable, which exists out there independent of consciousness. Realism so far has generally been a cruder idealism, dealing in abstract conceptual entities, but not suspecting that they were conceptual. With realism (until recently at least) as with idealism, a static conceptual construction is made to do service for real process. Instead of hypostatizing his ideal demand for truth and unity, the realist hypostatizes his atoms and molecules, his material and immaterial substances, and other working hypotheses.

A real dynamism, on the other hand, must make truth relative to process, not process to truth. Truth is the way a cumulative process looks upon itself at a certain stage of its development and to meet certain demands. If process is real, then reality is infinite, and truth never can exhaust reality. In other words, it will take an infinite number of truth universes to register or symbolize a universe of process.

CHAPTER IV.

TRUTH AND PROCESS.

It would be difficult to understand how the obvious facts of process, enforced all the time by the world of both objective perception and inner appreciation, and requiring perpetual readjustments in our world of practical relations, could have been so stubbornly ignored in philosophy, if it were not for a deep-seated demand in the human mind for permanency and unity. Only in a world with some permanency of character or constitution is truth possible. Only in a world which admits of definite structure, where past process can somehow crystallize into present habits, could the conditions of higher consciousness be realized. It is because, somehow, we can store up the past in the present that our own life comes to have meaning. If we take the social point of view, it is only because there is a large degree of uniformity in the world beyond our private consciousness, because processes for practical purposes do repeat themselves, that we can have such a measure of expectancy as makes adjustment possible. Process itself is inconceivable except for some grist to grind, a structural aspect which can be continually retransformed. Negation *in vacuo* is at best a logical abstraction and nothing more.

In a world of mere static structure, on the other hand, there could be no concepts and therefore no truth. In a world without variation of attention, existence and consciousness must be inseparably agglutinated. It is, because in the fleeting changes of our experience some more permanent contents are abstracted and become representative of other more concrete and therefore more variable contents, that we come to have concepts and judgments. Those mental structures, in other words, that are constituted by the common characteristics of experience are sharable and permanent, as the others are not, and so can serve as symbols for the rest. Our concepts are tools, in the service of the will, by means of which the self learns to anticipate a varying environment, the self becoming conscious as it learns better to define its needs in terms of the objects of the environment and at the same time learns to define the objects, that limit it, in terms of its needs.

There seems, therefore, to be an antinomy involved in reality itself. We must, on the one hand, acknowledge the structure aspect of the world, for without that we should have abstract non-being only, and consciousness and object alike would vanish. On the other hand, we must acknowledge the time aspect, the non-being factor, for without that the variations in our meanings and practical attitudes would be unintelligible, whether looked at from the subjective or objective point of view. Moreover, it is only as structure becomes function, as it does something, that it can have meaning at all. Structure in the end must be regarded as a conceptual abstraction to account for the relative uniformity of process. In the world as we know it and to which we must adjust ourselves, the structural aspect and the non-being aspect must both be taken account of in order for us to get a consistent conceptual description. Truth presupposes a changing and pluralistic world. I will not here discuss the fact that social interaction seems to be necessary for the arising of thought, though that would probably be admitted. What I have tried to show is that in any solid block world there could be nothing but pure immediacy. The conditions for truth are wanting.

It is further clear that the only reality, which we can take account of and assume practical attitudes toward, must be a reality of experience. Though this has been a subject for profound dialectic, it is a mere truism. It is simply saying that what exists for us does exist for us, and conversely that what has no existence for us has no existence for us. The only data any one ever had or ever will have are his own states of consciousness, the only law or order which we can discover in the universe must be the result of our projecting our own ideal demands of consistency and simplicity, and our concepts sorted on the basis of such postulates. If experience is all we can know, then it is at best a useless hypothesis to postulate something outside, external and foreign to experience. While anthropomorphism is poor philosophy, as I shall show later, yet it is right in so far that there must be some continuity between the knowing thought and the object it strives to know.

The trouble with idealistic philosophy in the past is that it has dealt with too narrow a definition of experience. It is built upon the presupposition that experience is fundamentally reflective. Only self-conscious experience counts. The truism, no object without a subject and vice versa, does not apply at all to that vast mass of experience where reflection has not arisen and where, therefore, the subject-object relation does not exist. Even in human experience it is a comparatively small part that is reflective, and we do not have to go very far down into the animal scale, before 'awareness of' takes the place of any 'knowledge about.'

What sort of reality do we have in dreamless sleep for example? Is our only reality to be the content of some reflective consciousness? But if our own reality in such a condition equals zero, why is it that our being asleep has important consequences for our further thought activity? We went to sleep tired, unable to think out the simplest problem, but we wake up refreshed and in a new mood altogether, and perhaps the problems have solved themselves. Something must have been doing, while subject and object had vanished out of existence, for such important consequences to be produced to thinking itself. There is here a continuity of experience which cannot be stated in reflective or teleological terms as regards its own being.

In the process of communication with other individuals we have paid attention in the past only to the termini of the telephone or adjustment. We have failed to take account of the intermediary processes, which make the two consciousnesses continuous with each other. It is only in highly special cases where the hypothesis of thought transference and a common sub-conscious or sub-attentive soul life has been invoked. In order for any communication whatsoever to be possible, however, there must be some sort of continuity between the minds communicating. What we call the world of physical processes intervening must be merely a continuum of marginal or subconscious processes, which make the world akin and make it possible for our private consciousnesses to hold hands and to some extent move together.

While we recognize, therefore, the importance of the postulate of continuity for knowledge, while we seem to be driven by the nature of our thought to the assumption that only like can act upon like, and that, therefore, there must be some community of stuff in the universe, yet we are not therefore warranted in assuming identity of conscious content, as absolute idealism does. The novelty, which results from communication for the individual consciousness, and the leaps in the evolution of consciousness, both in the race and the individual, especially the inductive or reflective leap, would not be accounted for by the assumption of an identical, unvarying consciousness. Even if we assumed such a consciousness, we should have to go to work and explain all the variations or processes of evolution independently of it. It would in the end be as useless as Plato finds Anaxogoras' νοῦς and as Professor James finds the traditional soul.

For our purposes, at any rate, a large part of the universe may be treated as material. It can be used as means to an end, without any need of respecting any end there. While even the simplest structures of reality must be continuous in some way with the history out of which our conscious life has emerged, yet whatever experience stuff may be back of their dead semblance, it is so simple and stereotyped that to us, except in some occasional poetic moods, it does not mean psychic reality at all. To speak of these simple inorganic and lower organic structures as potentially self-conscious would be as useless as it would be false. It is their present being with which we are concerned. As, moreover, they have a history as old as the higher forms, they cannot be regarded as in a process of development toward higher forms. They are adapted to their own kind of environment.

Continuity, as far as we are concerned with it, only means the possibility of arranging our facts in a series of graduated difference. The only case where we have immediate consciousness of continuity is in our own activity as in the drawing of the line, in every other case continuity is a postulate. In the case of the historic strata or forms, we believe there has been such a flow; and this belief seems the simplest way of accounting for the facts. So far, however, from the unity of thought being the only kind of continuity it is evident that ideal continuity presupposes real continuity or continuity of process. The latter type of continuity is postulated in every act of communication, through our own non-reflective moments including sleep, and throughout history below the reflective level.

The definition of reality, therefore, in teleological terms, which seems to be prevalent to-day in all schools, which is the method both of absolute idealism and empirical idealism, has obvious limitations on the ontological side. For logic and epistemology it is true that reality has meaning to us only in so far as we define it in terms of our purposes. Knowledge, as Spencer and James have shown, is a tool constructed in the service of our demands or needs, a sorting process that makes the universe amenable and valuable to us. But to maintain, because we are forced to translate the universe into terms of our interests or purposes, that the universe, therefore, is adequately accounted for when expressed in terms of the fulfilment of purpose or teleological fitness is anthropomorphism of the grossest kind.

The humanistic standpoint is indeed preferable to that of the absolute idealist, who is trying to foist upon us his own ideal of knowledge as the absolute. If there is in the universe such a supra-human consciousness, we should at any rate do the same violence to it that we are doing to infra-human consciousness in translating it into terms of our human purposes. But the position of empirical idealism, that the universe is significant for us only as we define it in terms of our purposes or needs, is, after all, a mere truism. It only amounts to saying that the universe is significant for us, when it is significant for us. It is a definition of the nature of our knowing, in terms of itself, but not an account of being.

While empirical idealism is more modest than absolute idealism, and the truer account of such knowing as is possible for us, it, in the end, ignores process as effectually as the latter.

Only fulfilment or attainment can be real. Ignorance, failure, absence of purposive consciousness, are brushed aside as unreal. And yet how much of human life is reflective? Is the reality of the other moments, the non-reflective states, such as instinctive and emotional states, simply their existence in a reflective state, which defines them in terms of itself? If so, the presence of an eternal, absolute consciousness would seem to be called for. This, however, is simply the denial of the reality of all non-reflective consciousness *as such*. While such consciousness may be purposive to a reflective moment, which treats it as means to its own end, it was not purposive to itself. And yet it was something in order to fulfill purpose. To call it potentially or implicitly purposive is simply another way of denying it reality in its own right and treating it as a *mere* means.

While knowing, then, is an important aspect of reality, we must not try to resolve all of experience into the attitude of knowing. Self-consciousness at most is a small part of life. To the sleeper, whether human or sleeping nature, there is no significance. Significance appears only, when, after passing through intermediary stages, he has become awake. But, unless the sleeper had reality, his waking would have no significance. His reality as a sleeper, therefore, is continuous with reality as being awake and having significance, but is a different reality, whether regarded from the social or individual side. Because for practical purposes we can regard some forms of reality as means to an end, we must not deny them reality, because then they would not even be means or limitations.

Schopenhauer's translation of the lower stages of reality into terms of will is only another form of modern animism. He attempts to strip his own experience of everything but striving or yearning, and then ejects this abstraction of his own experience as the identical essence of the universe. This is poetic at least, if it is not philosophical. There is no such thing, however, as identity of content in the evolutionary processes of the universe. You cannot get a middle term between the simpler and complexer forms of consciousness. There is such continuity, indeed, in the series, as makes some anticipation possible. But continuity does not mean identity. If it did, process would disappear. We cannot properly speak of the lower stages as experience even, in the sense we usually attach to the term. All we can say is that they are continuous with what we call experience, that, in the greater complexity of the succeeding changes, they issued into human experience. But the simpler existences were then no longer.

I want to register a protest, therefore, on the one hand, against the presumption of absolutism to a supra-human knowledge. We do not in any sense compare our fragmentary human knowledge with an absolute knowledge or meaning. If so, we should be fools indeed for not throwing away the 'worser' half, our finite knowledge with its illusions and imperfections, and for not keeping the better half, the complete and absolute. We do, indeed, criticize our present concepts, but not in the light of adequate concepts, which we do not possess, but in the light of certain demands, which we are so constituted as to make — demands for consistency and unity. Contradiction is to us, while thinking, a standing challenge to further thinking and investigation. But this challenge obviously does not mean a knowledge of the unitary whole which we are seeking and may never attain. The only absolute thing about the attitude of knowledge, when we have it, is the demand for knowledge, the faith that the seeming chaos can be reduced to order or meaning. Somehow, too, we may believe that the universe is responsible for this demand. If we, clay of the universal clay, awaken at moments to make such demands, these demands cannot be entirely foreign to the stuff that the universe is made of, though the concrete meaning of these demands must vary with every stage of experience. All we can say is that consciousness, at a certain stage of its development, does make certain demands, does take the reflective leap. This surely could not be accounted for by a consciousness always reflective. The satisfaction or discontent of one moment, so far from pointing to familiarity with the Absolute or comparison with an absolute standard, may prove equally relative as measured in terms of subsequent moments. Our errors of previous moments may prove truth and our truths error. All we can say is that the click of satisfaction and the pain of restlessness feel absolute to the moment that has them. They may prove prophetic of future moments or they may not. We must take the risk.

But I want to register a protest, on the other hand, against the anthropomorphic subjectivism of empirical idealism. As against this tendency, I want to emphasize Butler's important contribution to modern thought, that our impulses are essentially centrifugal. They aim at objects, not mearly at meaning or definition of themselves, though, in working themselves out, they sometimes come to have meaning. They aim at objects that shall satisfy, to be sure, but at objects. Self-consciousness is a secondary consideration, developed to meet unusual adjustments and evanescent even with the highest consciousness. There can be no realization of will, except with reference to objects beyond the will. If the object is identical with the will all the while, the process becomes a farce and an illusion. If you try to account for the process as a coming to consciousness of the will of its own meaning, you have to explain at least the illusion of its discontent.

The will requires, therefore, individuals beyond itself to realize itself. The reply, in Wagner's drama, of Brunhilda to Sigfried, when he is in love: Liebe dich, seems rightly absurd to him. What a subjective mire the will would wallow in, if it only really loved itself. Our conceptual attitudes are indeed conveniences for us in manipulating our world; it is advantageous sometimes to treat the universe as means to an end, the mere objectification of our desires. Any conscious animal, however, would have the privilege of making a universe in its own likeness on such a principle.

But while concepts are convenient tools, they remain to the end tools, in dealing with the non-conceptual world. Though we conceive the clam in terms of satisfying hunger, as capable of chemical analysis, good for dissection, etc., we have to the end simply given our subjective attitudes. There remains the clam, without which our various desires would simply return upon themselves as empty as before. The clam must have reality, it must be some kind of content, otherwise our attitudes toward it are all unreal. But the clam itself has no meaning. Its inner constitution is at best a very sleepy affair. Our knowledge of the clam, then, simply systematizes our attitudes toward the clam. But all of them together, yes unified, are in a different dimension from the consciousness of the real clam. Hence it is that the unity of our attitudes, however complete, can never create the existence of the clam nor can our denial annihilate it, if it is existent. The empirical idealist, then, who tries to translate the universe into subjective, human significance, simply moves within a circle. He too has mistaken the continuity of consciousness with its world for identity, and to vindicate his position must presuppose an identical, absolute consciousness.

We have no right then, I hold, to translate into terms of concepts states of consciousness which are not conceptual, except for merely practical ends. No amount of conceptual definition can give us a real equivalent for a sensational consciousness. It is simply the substituting of another kind of reality, exclusive of the former. Sensation, reflected upon, is not sensation.

The only instances where our conceptualizing activity deals with the essence of objective reality, or gives us an equivalent in kind for objective reality, is when the object itself is a conceptual state or the record of such a state. Thus, when we deal with Hamlet or a system of scientific classification, the object we try to grasp is itself a meaning. We are at least not doing violence to the object, in such a case, by making that conceptual, which is not. It belongs to the same grade of reality. The difficulty in such a case is to get the *same* meaning that Shakespeare had, which of course would only be possible if we could reproduce the same conditions, *i. e.*, if we could be identical with Shakespeare at the time he conceived Hamlet. The conceptual object, too, as some one's meaning can be grasped by another individual only as *his* meaning, and the so-called sameness or universality of meaning is again only a matter of social convenience.

Nor would an absolute consciousness for whom the universe is one moment of meaning, is included in one conceptual definition, be any better off. Such a consciousness, if inclusive, in knowing the finite and individual facts would have to transform them into terms of itself and so would destroy that which they are. If, on the other hand, a total consciousness is conceived, which has present within its unity non-reflective contents, a fringe as well as a thought focus, then to it, too, the universe would be dark and unintelligible in part. Inasmuch, however, as a supra-human consciousness can only be conceived by us in terms of our own experience, if we give it any content at all, it becomes at most a demand for unity and wholeness on the part of our consciousness.

That there is a plurality of meanings in the world, as well as a plurality of non-reflective objects, is constantly brought to our attention. While we mean to mean the other meanings and the other objects, we discover through further experience, or in later meanings, that we failed to understand the other meanings, and therefore failed to adjust ourselves properly. If there were only my own timeless meaning, I could not fail to mean what I mean. But even when there was a mutual understanding of meanings, even when we reached an agreement for working purposes, I may discover in the successive stages of my own reflective life, while my meaning of the other meanings or non-reflective objects remains, that what I meant has disappeared or is no longer what I mean. While the meanings seemed to tally for the time being, the successive moments of the meanings fail to tally. Therefore, the individualities of the two meanings must be different. The meaning of one cannot be exhausted in terms of the other. The differentiation of individuals is thus an *a posteriori* process, and the validity of our postulates and categories with reference to our larger world is not the result of any *a priori* fitness, but is the result of a long process of testing and survival with reference to our needs. Our needs, moreover, are not absolute quantities, but vary with the different stages of development.

The conceptualizing or knowing attitude is final, only when it deals with itself. We can exhaust the reality of the object in the concept only when thought makes its own object, when the meaning and the object, therefore, are identical. Shakespeare knows what Shakespeare's Hamlet means at the time that he conceives Hamlet. His consciousness of his own meaning is final, insofar as it is then and there his meaning. Later he may have a different meaning, the same lines may mean something new to him, he may even forget his original meaning. But a new meaning is not something more added to an old meaning; it is a different meaning continuous with the old, but not quantitatively divisible any more than the old meaning. Only the state of consciousness, therefore, which has the meaning, is a final judge of the meaning. And the reality of the meaning is what it means to that state of consciousness and nothing else. That meaning may lead to consequences for further thinking, which were not foreseen at the time, but such consequences are not implied or meant in any sense until they are discovered. The meaning has changed, because the self has changed. Only a new self, a new reality can have a new meaning. Meanings do not enlarge themselves, do not ascend by pulling their own boot straps; they grow, they come to have a larger reference, only because the self becomes a new self, adjusted to a larger world. To have a meaning and to know what one means are only two ways of saying the same thing.

While empirical idealism does not furnish a satisfactory metaphysics, it does furnish a good account of knowledge. Our knowledge is conditioned by our selective interest, as Professor James has so brilliantly shown. Our concepts are tools by means of which we become able to manipulate things. Truth, as far as we are concerned, must be tested with reference to the consequences of things to *us*. The relation of things to our needs or demands is fundamental, as far as we are concerned. What matters it to us, if we conceptualize that which is not conceptual, if we systematize and order individuals according to the value they have for us, irrespective of their own order or lack of it, if so we can accomplish our purposes, become more confortable in the world in which we find ourselves? For us the universe is a universe to fulfill certain demands, practical and theoretical, and we naturally make ourselves at home accordingly and order the universe to do our bidding. If the taking account of things as they appear to us helps us to get what we want, our knowledge is naturally deemed satisfactory. If we have knowledge at all, it must be anthropomorphic, it must be our interpretation in terms of our own experience. What care we that it does violence perhaps to other forms of experience, if thus we are enabled to live?

Knowledge, then, is an instrument in the service of the will to enable us to anticipate the environment in a way that will prove serviceable to us. Not what reality is, but what reality does to us, is the important question for knowledge. The other terminus to the relation may be below the conceptual level, may be for all we know unconscious altogether, but that it does things to us, that it can be utilized by us, or at any rate that we take pleasure in order as opposed to chaos, is a sufficient reason for arranging the facts, irrespective of what they may be, in a scheme to suit our needs.

What nature is for us, then, is determined by the tendencies or interests with which we confront the world, and may have very little to do with what nature is in itself. Order and meaning in other words, are categories of reflective consciousness, irrelevant where there is no reflective consciousness, but convenient for us in adjusting ourselves to our world. They are order and meaning to us, but need not be so to the things ordered; and, when they are order and meaning to them, they need not be the same meaning.

Thinking itself, therefore, and our categories of thinking have survived, because they have proved serviceable to such beings as we are. It has proved convenient for us to translate the universe into the terminology of human experience, however different from the human it may be in parts. While the facts may know no place in a series, it has proved convenient for us to arrange them in a series. While the individuals themselves have no tag giving them a number, it is convenient for the census taker to tag them as first, second, third, etc. While the successive changes in things may be nothing to each other, yet for our reflective consciousness it is convenient to regard them as causally related, as instances of one law, or as evidence for our hypothesis.

I have tried to show in this chapter that all reality cannot be translated into the reflective type of consciousness without violating and destroying its own integrity. There are various grades or stages of experience, which reflection itself must take account of, and only a small part of experience, at any one time, can be regarded as reflective. This is true of human consciousness and must be true to a vastly greater extent of infra-human consciousness.

The passing from one grade of experience to another, the passing, for example, from the non-reflective to the reflective type, must be regarded as a leap, a creative act, or must be accepted by us as a fact or gift. The same, however, is true in passing from one non-reflective type to another, as from sensational experience to that where memory and efficient guidance are involved. The same is likewise true in passing from one type of reflective consciousness to another. Such passing we speak of as a new insight, a discovery, a stroke of genius, a work of creative imagination, all indicating that we have to deal here with a gift. Each conscious unity, we find, is a closed circle to itself and cannot predict or compound a new unity out of itself. When the new unity comes, it supplants the old and the old is no more. The old is only a fact for the new. The new meaning, however, while unpredictable *a priori*, looked at *a posteriori* seems continuous with the past, fits in. It fits in because the past has been transformed and appropriated into the present meaning. It has no reality except as it is interpreted by a present subject. As past it has been destroyed.

If this is a true conception of reality, knowledge will fall into two main divisions. Reflective consciousness, insofar as it translates non-reflective consciousness into terms of itself for its own convenience, for the sake of realizing practical ends or getting the æsthetic satisfaction of greater unity of facts, does not give us an equivalent in kind for the reality with which it deals. It defines that in terms of its own ends, which in its own reality has no end or meaning. It simply misses the reality of those conscious states, which can only be had, when reflection does not exist. Non-reflective reality does indeed report itself to reflective consciousness as things, as unities of properties or sense qualities, having a certain relation to our ends. But this unity and these properites have existence only for us as taking account of them. They are, for the time being, a real relation to such a consciousness as ours. To themselves, however, the non-reflective things have neither unity nor properties. They are their own sleepy selves. To call them 'possible experience' is simply another way of translating them into terms of our own reflective attitudes. But to be possible relations to us, they must be more than the mere subjective attitude of possible. They must be, somehow, experience in their own right. Use what sort of terminology we may, therefore, knowledge on this level of reality gives us only symbolic equivalents or correspondence and may be called phenomenal knowledge.

The other kind of knowledge deals with a reality of its own kind. It is a reflective state interpreting a reflective state, either immediately communicated or recorded. Here knowledge gives a real equivalent. Even here, however, knowledge can only be exhaustive, when it creates its own object, when the meaning means itself. But, even when the relation is not that of identity of meaning and object, there can at least be approximation. The other meaning is necessarily transformed for the time being into terms of the subjective meaning. This transformation, however, must be tested by consequences to the individual experience. Can it predict on the basis of this transformation, adjust its conduct with reference to its meaning and become successful? If so, well and good; our meaning is then practically equivalent, even though not identical. If not, our meaning must be revised on the basis of our failure and the experiment tried again. The common characters and uniformities of experience at least permit of such practical and social agreement or approximation.

While in the latter case, therefore, it would only be possible to have absolute sameness of meaning, if we had one unchanging meaning, conscious of itself only, and while meanings do violence to each other in transforming each other into terms of themselves, we have here at any rate a knowledge of meaning by meaning, and so real knowledge, as contrasted with phenomenal knowledge.

CHAPTER V.

THE PROBLEMATIC.

A. *The Ejection of the Time Series into a New Dimension.*

There are two things necessary in order to understand the significance for us of the past. The past has a non-being aspect, without which it could not mean past at all. The content of the past world exists no longer as such, it exists only as it has been taken up and transmuted in the ongoing movement of experience. The Greeks are no longer besieging Troy, Cæsar is no longer crossing the Rubicon, though those experiences are continuous in history with events and civilizations now real. The question arises, however, if the past world is a world of absolute non-being in its own right, why should we have even the ideal construction of such a world? How can we mean or refer to such a world at all?

The reason that we can construct the past at all is that it involves, beside this attitude of non-being, characteristics or layers within the present that give us a formal or symbolic basis for our past construction. The past is not a mere fiction. It is not for us to make chronology as we please. While the past has no facts of its own, it has a factual basis within the present, which we cannot ignore. Perhaps I can make this clearer by an analogy. If we examine the geological strata, we find the basis within them of a certain series. There are, however, no past layers. All the strata are present strata; all the characteristics are now characteristics. Should the mountain become conscious of itself, however, it could construct a series of conditions, no longer existing, to account for its present character. A better illustration would be a tree. A tree has various layers or rings that enable us to tell something about the history of it. Suppose the tree should become self-conscious, it could construct a series of conditions to account for its present state; and, if it did construct such a series at all, it would have to construct it in a certain way, owing to its present character. Yet there are no past layers or rings. There is only the present tree as an organic unity, suffused with present sap.

So our reflective moment discovers within itself certain characteristics, certain symbols, survivals in the way of memory, as a survival within the individual organism, or records, which are the survivals within larger social processes, which make it possible to construct an order or series of attitudes which we call history. The feeling of duration itself is a present feeling, however much it may help us in giving significance to the ideal construction of a past series. If we choose to construct a series moreover, the present character of reality makes necessary a certain kind of order, which has a real or factual basis within the present. Each successive moment in the series is such as to supplant, to occupy the space of, and exclude the reality of each preceding moment.

Morover such a construction is necessary in order to make the present reflective moment intelligible at all. If the birth and the funeral and all the intervening stages were thrown together in one promiscuous mass, experience would be a hopeless chaos. The individual attitudes or meanings, with which history deals, are exclusive of each other, each claims the whole universe for its own, fills the whole of space with its three dimensions. The point of view of the Homeric world, with its gods and heroes; the point of view of the age of Pericles with its art and its philosophy; the world of Cæsar with its conquests and its political ideals, each fills the universe with its presence and does not recognize the reality of the other. In such a Babel of tongues, a timeless view of the world would simply have to commit suicide by abandoning the law of contradiction altogether.

The confusion, however, can be resolved, if we regard experience as making itself anew, as an essentially creative universe, which to some extent at least accumulates past experience into present structure, and transforms present structure into new experience. Each moment of experience brings its space with it, spreads its content out into its spatial and other ideal series. There is no inconsistency any longer in each point of view claiming the whole universe. Each individual meaning claims *its* universe. When the old meaning and its universe only survive as taken account of by a new point of view in a new universe, the old point of view and the old universe still are seen to fit each other, and no attempt is made to rob the old meaning of its universe.

Thus the present real self, ‘the heir of all the ages,’ finds it convenient to look upon itself as one out of a series of universes, which have been retransmuted and superseded, in order to understand its own constitution and define its own expectancies. This is true not only in regard to the spreading out of the past will attitudes into history proper. The self also finds it convenient to spread out experience below the reflective level into an evolutionary series in order better to understand the present forms of being and their characteristics; and thus we have theories of biological and geological evolution and nebular hypotheses. Here we simply translate that which knows no meaning or order, which knows no history, into meaning and history for our own convenience, on the basis of certain structural characteristics, as they exist for us.

B. *Knowledge of the Present and the Past Contrasted.*

The present is the field of scientific observation and practical attitudes. Science deals with a now constitution of reality, on the basis of which we can link our facts and anticipate the behavior of things. To obtain such uniformities, science necessarily abstracts from the individual aspect of things and decomposes reality into artificial attitudes, convenient but only partially real. Ethics on the other hand aims to deal with reality as real and individual. It deals with the adjustment of individuals to each other in social life, in which alone they can realize their needs.

There is a peculiarity about the real relationships of the present context of experience, which the symbolic past lacks, that of living response or reciprocity. This has been strikingly pointed out by Plato in the *Phædrus*, where he discusses the advantages of living communication over written records. “Writing,” Socrates is made to say, “is unfortunately like painting;

for the creations of the painter have the attitude of life, and yet, if you ask them a question, they preserve a solemn silence. And the same may be said of speeches. You would imagine that they had intelligence, but if you want to know anything and put a question to one of them, the speaker always gives one unvarying answer. And when they have once been written down, they are tossed about anywhere among those who do and among those who do not understand them. And they have no reticenses or proprieties toward different classes of persons; and, if they are unjustly assailed or abused, their parent is needed to protect his offspring, for they cannot protect themselves."

The dialectic of the past, in other words, is a one-sided affair. The living speaker himself develops his meaning to his own satisfaction, and that is all that can be asked. Future moments may find the present meaning partial and unsatisfactory, but the symbolic past itself makes no response, says neither yes nor no, offers neither resistance nor encouragement. It is plastic in the hands of the present moment, means to a present end merely, and yet does not complain, does not stand up for its own integrity.

Not so with the individual moments, which really touch or run into each other through their subattentive margins, in the present continuum of experience. Here you have a two sided dialectic, a yes and no relation. Misconstrue the other consciousness and you fail of agreement, fail to realize your purposes. The other reflective consciousness has a meaning and insists that he means what he means, refuses to be the mere instrument to your end. If you would share his life and realize your own larger life, you must revise your meaning of his meaning so as to approximate more closely to the latter. The more comprehensive and sympathetic your meaning, the greater your opportunities for life. Would you construe him simply in your own way, treat him as a mere thing, then you run up against it, you are slapped in the face, sometimes literally; whether you are successful or unsuccessful in this external dogmatism, you forfeit your chances for a larger life, you fail in the struggle. The only way you can succeed is by an acknowledgment of the demands which the other consciousness makes upon you.

The infra-reflective nature processes correspond for us to the past, insofar that for us they are merely symbolic constructions for individual convenience. No acknowledgment of external meaning is here necessary. To use these processes, therefore, as mere means calls for no protest, and the test of truth on this level is simply the success of such manipulation.

In the relationship of self-conscious individuals within the present social continuum, on the other hand, conscious agreements become necessary. Each individual to realize his demands must learn to recognize the demands which are made upon him by other individuals. Only as there is a mutual recognition of such demands, do social institutions become possible. What beings we are forced to acknowledge as individuals, and the character of these individuals for us, depend upon the demands which we must adjust ourselves to, or recognize in order to realize our own purposes; and the adequacy, on the other hand, of the realization of our purposes will depend upon the adequacy of our recognition of these demands. The closer the approximation of our meaning to the living purposes of other beings, the better we shall succeed in anticipating their behavior and adjusting ourselves.

That there are different individuals, however, can never be proved *a priori*. *A priori* the ego never could get away from itself, would simply have to create its own non-ego outright, and this would be no non-ego at all. A non-ego, which should simply exist as an act of our positing, would indeed be beautifully transparent and controllable, but it would be absolutely barren too, as far as satisfying any needs. It is only *a posteriori*, through our failures of adjustment, that we have come to recognize other individuals at all. And it is only through the *a posteriori* process of ideal construction and trial that we have learned to meet the non-ego in a more adequate way.

At best, however, our knowledge of other individual consciousnesses is a matter of approximation. We cannot be sure of getting the real significance of a meaning beyond our own. Absolute knowledge of such a meaning, as we have seen, would be identity and so would destroy the meaning as individual. Communication and conceptual definition are concerned with whether we aim at the same objects in each other's experience, not with identity of meaning as regards such objects. Functional identity is all that is necessary for practical relations. The important thing is not whether our meanings are the same, but whether they terminate in similar behavior. If so our meanings may be taken as equivalent.

Sameness of meaning, at any one time, would mean absolute sameness of conditions or mere identity. If there are individual meanings at all, this will be impossible. And we must behave at any rate, as if there were different individuals. The greater the sameness of conditions, however, the greater the sameness of meaning. Twins, it has been shown, manifest a great deal of likeness as regards tastes and preferences. But however closely alike the objective conditions may be, there is a difference in subjective conditions, difference in emphasis, difference in initiative and choices. It is not possible, therefore, to infer with any degree of accuracy from one individual to another.

The greater the disparity in conditions and meaning, the more difficult becomes the problem of agreement or common understanding even in the crudest ways. How difficult it is for us to interpret the child consciousness and sympathize with its aims. We treat them just like little big people. How little sympathy we show with savage races, and how little, if any, significance we attribute to their lives. Still more problematic becomes our knowledge in regard to animal consciousness. We are either apt to deny to the higher animals any significant life or else to attribute to them our own consciousness. In the lowest organisms and in the inorganic realm, consciousness becomes a mere demand for continuity, as far as we are concerned.

Even in the living present, then, and where the conditions are most favorable, our knowledge is decidedly problematic. The value of our knowledge, even on the highest level of development, must be estimated from the point of view of convenience for action and enjoyment, rather than with reference to exhaustiveness.

In the meantime, since reality is individual, and because the individual is dynamic, there is an element of non-being in our knowledge. Our ideal construction gives a content of its own to reality beyond. And as the reality beyond is ever changing, the prospect of exhausting the surd and reducing the universe to the dead level of sameness is a dream at most of those philosophers, in whom the passion for sameness overmasters every other passion. Only in a world of abstract averages could such a permanent instinctive adjustment, as Spencer dreams of, be possible, not surely in a world of unstable individual equilibriums, with the possibility always of new insight as well as the possibility of going wrong. Each creative act, whether new purpose or sin, changes the total complexion of the universe and involves a fresh readjustment. In a world like ours, therefore, there will always be coexistent many experience moments with their different perspectives of history and nature, each with its space world and its scale of values. Sameness for us is, at best, a category of conceptual abstraction, to be used insofar as it may be convenient. Better live in a problematic and contingent world, however, with something to do and something to attain, than suffer from the *langeweile* and dull monotony of a world where nothing happens.

The difficulty with the past, as we have seen, is that it makes no living response or resistance. We are dealing here with attitudes no longer real. We may find analogous attitudes coexisting with us, as in the case of savages, but they too are evolved attitudes under differing conditions. As to the past attitudes themselves, we must rely on records, but the records are merely symbolic of past points of view. These have been taken up, and, through intermediate stages of interpretation usually, transmuted into the reflective consciousness of the present. The thought universe, within which they lived, is at most only a partial world to us, a stage in the evolution of our own experience, while to them it was the whole world. The mythological world for example, which was reality itself to our ancestors, is a mere shadow world to us, at best preparatory for better things. It was a belief world to them, it is mere fancy to us. We do not get the past attitudes or meanings *as such*, we get them only as transmuted and appropriated into the historic movements that have succeeded them. That is their significance for us. How plastic history is, is evident from the difference in emphasis and interpretation from age to age. Each age uses history for its own ends, reconstructs the past for the sake of its own purposes, and in obedience to its own needs. The more comprehensive the point of view grows, the more hopeless is any realization of the real meaning of the primitive attitudes. Sometimes there has been an attempt to regard the past as resolvable into mere degrees of complexity with reference to the present. This as an artificial device may be justifiable. It is convenient sometimes to regard the savage and the baby consciousness as our consciousness simplified, to regard their reactions as realizing purposes of will. Such meaning as we get out of the universe must naturally, as shown before, involve such a translation into terms of ourselves.

History must be regarded, then, as our ideal construction on the basis of present symbols, which represent a factual order, now real only for us. Its justification is a practical one. In appropriating the institutional or accumulated life, we come to consciousness of ourselves, we come to understand *our* world better and anticipate better its behavior, though the music and discord of the past have been merged into the movement of the present. We can act more intelligently, in other words, for understanding those present characteristics, which we can only make consistent by arranging them in a serial order, as exclusive of each other, in a new dimension. The past dimension is convenient for spreading out certain present strata and observing their tendency for us. In order to have history at all, human, biological, or geological, we must abstract and simplify as best we can within our complex present; we must try to understand the motives of past human history, for example, in the light of our own present tendencies; we must breathe into the symbolic structures of the dead past such soul as seems to be called for by their greater simplicity or complexity. But we must not be deceived into mistaking our constructions for reality. These past symbolic structures, once at any rate, had a soul of their own. In the case of our own childhood points of view, moreover, while they are no longer real, we at least own them as once ours, and can contrast them with our present point of view as fading, symbolic structures.

In looking back at the historic series, as we have spread it out, it seems indeed to bear the stamp of necessity. But this necessity is merely subjective and *a posteriori*, and should not be read into the historic process. It simply means that we could not now take account of the facts in a different order or with a different meaning. Even with us, however, this meaning varies from time to time, is plastic in the hands of the successive moments of experience. If we look again into the making of history, we must not forget, however massive the accumulation of experience in the way of customs, language, and institutions may seem, that individuals built history and that the social products are the result of their accumulated purposes and failures. In the making, as well as now in the interpretation, the facts were plastic. While the facts now fitted in and seem the natural outgrowth of their predecessors, other facts, had they happened, would have fit in equally well by transforming their predecessors into terms of themselves. The facts themselves are gifts, therefore, and it is for us to fit them together as best may suit our purposes for the time being. The only place, where the past is determined or stereotyped, is in a stereotyped brain, in a mind that has substituted verbal counters for real meanings.

C. *Knowledge of the Future.* — *The A Priori and Probable.*

The future is like the past in so far that it has no content. What meaning it has is present meaning. But the past has at least a formal basis for reality. It has a chronology which is binding upon us. We must respect the records of the past as records. The future has not even formal reality. It knows no records, it respects no data. The future, therefore, is pure ideal construction. It has no factual basis even in the present.

The only basis for the future is a belief in the uniformity of nature, is a faith that the present attitudes are legislative for those to come. The future is the realm of the *a priori*, the present constitution of things extended into the unknown dimension of that which is not yet. The future, therefore, based as it is upon general concepts abstracted from the individual character of reality, must always be hypothetical. Other things being equal, if our concepts hold, if the observed uniformities are real, such and such things will happen.

There is, therefore, no such thing as *pre*diction in any real sense. The *pre* should at any rate be left out. Science, in its ideal construction, abstracts from the time aspect and emphasizes only the structural aspect of reality. In treating of the physical processes, stereotyped as they are, we do seem to have a case of mere repetition. But it would be mere dogmatism to suppose that even here we have a real repetition. It is simply repetition for us, as indeed scientific knowledge is only knowledge for us, a convenience for our adjustment.

If we take account of our own scientific attitudes, they surely are anything but stable. The so-called laws and axioms of science are being retranslated all the while. The only identity here is the identity of mere symbols, not of meaning surely. The symbols, $2 + 2 = 4$, may be the same, but our whole conception of number has been revolutionized within a generation. The axioms of geometry, which seemed so absolute even to the English empiricists, have been sadly torn to pieces within recent times and have received a new meaning altogether. The only thing that has been stable about the law of gravitation are the symbolic equations. The conception of the law itself is in the crucible of criticism. The law of conservation of energy is no longer dogmatically asserted even by physicists. La Grange grants that energy may disappear, and Maxwell that it may be increased through a sorting process. It is, however, an important working basis. In the light of history, therefore, it would be mere idiocy to suppose that our conceptual attitudes toward nature are stable.

When, again, we consider knowledge which is knowledge of the real, which deals with the plastic world of meaning, here, at any rate, mere *a priori* dogmatism soon proves its own absurdity. The man who makes the social and individual future out of the whole cloth of the present, who regards his private attitudes as legislative for the processes of history, is bound to bitter disappointment, or at least to be the laughing stock of the future. The man who established the Dudlean lectureship at Harvard, in order that future ages might thunder forth their condemnation against 'the damnable heresies of the Catholic church,' would probably be as chagrined at the carrying out of the provisions of his will, as he is amusing to us. The world does move. A man by the name of Paine who gave five thousand dollars, something over a hundred years ago, to establish a trade school a hundred years in the future, did not realize that the apprentice system would vanish out of our institutions before then and that the courts of Massachusetts would have difficulty in translating his will into present purposes. Pessimistic theologians have mourned over the rejection of their religious concepts, their creeds of hell-fire, as Jonah mourned over his gourd, not realizing that it is more important that the universe should develop new meanings, than that it should be held in the death grip of their past concepts.

While we cannot anticipate that which is not created, while we cannot read off a meaning which can only come into being by a transformation of our present meaning, while it is always true that the present truth must die in order that the higher truth may come, it is true that the present makes certain demands upon itself, which the present does not satisfy. It may be that the demands are wrong, it may be that experience will embody the demands in a new and larger meaning, but in either case the present provides problems for the future and furnishes a certain direction to the future.

To recognize that the present makes demands upon itself which it cannot satisfy, is a very different thing, however, from holding that we now anticipate the fulfilment of these demands and compare our present meaning to a larger meaning. If so, knowledge would be complete now and eternally. We may realize that our hypotheses are inconsistent, and yet be limited to them. We believe that, somehow, knowledge will not stop there, that by creating new hypotheses and by fresh investigations there shall be a survival of the fittest, which will mean a greater approximation to truth, but if we could anticipate that truth now, we would be foolish not to stop working. Whether right or wrong, we must make violence on the kingdom of heaven by striving to coerce reality to fulfil our demands or needs. Whether we succeed or fail, we shall gain experience, in the light of which our demands or needs shall have new meaning for us. What is needed is an open mind to meet the future without bias or prejudice and to act on the light as God gives us to see the light every moment of our experience.

Nor must we be overconsistent. It may be necessary even in science, though its aim is a consistent system of truth, to hold to contradictory hypotheses for the time being, when such hypotheses are useful in dealing with the facts. It may be that the contradiction is involved in the nature of things. If so, we shall have system in so far as it is possible, and we shall be better able to anticipate the behavior of things. It may be, and we have a deep-rooted faith that this is so, that the contradiction is due to our own chaotic purposes. If so, such a measure of meaning as we can reach will be a necessary step for further progress. Waiting can only mean failure in any case.

It is a safe rule to stick to all those demands which seem essential for the largest life, whether we at present can reconcile them or not. For purposes of knowing it may be important to emphasize the unity and sameness and wholeness of things. Science seems to need what James calls a solid block universe in order to make prediction possible. For purposes of action, on the other hand, it may be important to take account of the diversity and individuality, the changing and incomplete character of things. For ethics, for example, the universe must be regarded as essentially individual and plastic, as amenable to human purposes and as indeterminate in character, if the individual life is to count for something.

While no *a priori* proof has any coerciveness over the real future, and while it will be impossible, therefore, to prove immortality, yet if the belief in immortality is essential to our present stage of progress, why should we sacrifice it? What seems essential now may not seem so in later stages of development, and our beliefs are bound to have new meaning as we go on, yet our beliefs are good only insofar as they now help us to live the richest possible life. The best religion, the absolute religion for us, is that which grows out of our present demands and meets our present needs.

Philosophy as a rule has emphasized the demand for unity and completeness. Yet no great philosopher, however strong his emphasis on that side, has been able to silence altogether the ethical demand. Leibnitz with his predeterminism holds that it is possible to determine oneself otherwise, to find one's own answer. Spinoza, the most cold-bloodedly consistent of them all, after having reduced the universe to a mere naturalistic determinism, in which our impulses and emotions must be what they are, finds in thinking the possibility of freedom. To have adequate ideas is to have adequate control. By thinking we can translate the blind impulsive and emotional life into a life of worth. Spinoza at least implies that a man ought to think.

It is well to keep in mind that knowledge does not exist for its own sake, but for the sake of the active self. Philosophy may have a creative function, such as poetry and art have. If by creating a certain kind of belief world we can attain to a larger life than we otherwise could, why is not the creation of such a belief world a legitimate thing, and why is it not a fact for the time being, as much as anything is a fact?

It seems evident, then, that our finite attitudes towards the universe are at best compromises. Sometimes they are contradictory, and only the more useful for it. When the Presbyterians added to their confession of preordination a clause on individual freedom and responsibility, they laid themselves open to the charge of inconsistency, but perhaps it was the best they could do, and at any rate they avowed openly what other religious creeds and philosophers imply. While consistency is important, our universe is too big for consistency, and we often have to hold on to postulates and hypotheses that conflict, because we cannot afford to do without any of them. They serve our needs. Perhaps the thinking and research of ages may resolve them into a more comprehensive view, perhaps they are involved in the very nature of things. In the meantime it behooves us to be modest; to be open minded; to allow fair play of opinions; and, while emphasizing what needs to be emphasized as we see it, to regard our results at best as decidedly provisional, stepping stones, let us hope, to better things.

> "It may be that the gulfs will wash us down,
> It may be we shall reach the Happy Isles,
> But something ere the end, some work of noble note may yet be done."[1]

[1] Huxley—Tennyson.

CHAPTER VI.

NON-BEING AND TIME.

In the light of the previous discussion, it may be well to examine afresh the concept of non-being. Historically viewed, there are two stages in this concept: the metaphysical stage, where non-being is affirmed or denied as an objective reality; and the logical or epistemological stage, where the discussion is transferred from the realm of objective reality to that of subjective attitudes.

A. *The Metaphysical Conception of Non-Being.*

The first to make prominent the concept of non-being in accounting for the world was Heracleitus. The flux of the perceptual world, the irreversibility of the observed processes, appeals to the genius of Heracleitus. Being cannot account for this flux, another principle must be found. It is because 'non-being sticks in being' that the universe is so unstable. To be sure Heracleitus could not be expected to be consistent. Owing to his lack of logical tools, the *ὅδος* seems to him as real as the flux and the process itself appears to be a circular one. There can be no doubt, however, of Heracleitus' recognition of non-being and its dynamic significance. To this the whole subsequent history of ancient philosophy testifies.

The refutation of non-being by Parmenides presupposes the ontological conception of Heracleitus and is limited by the same lack of logical tools. Parmenides holds that it is contradictory to assert non-being. If non-being is, it ceases to be non-being. It cannot be thought, "for it is the same thing that can be thought and that can be." Hence non-being is an illusion and the path, which asserts that non-being is, must be abandoned.

The difficulty with Parmenides is that he fails to distinguish between the thatness and the whatness of non-being. While the idea of non-being must exist as a state of consciousness, yet the character of non-being is precisely to make our judgments of being relative. It is the very fact of the relativity of being for us which forces us to postulate an opposite principle. It is not necessary that the whatness of an idea should resemble its thatness. Sometimes, indeed, that may be so. The idea of red may be reddish, if we are visualizers. The present content, however, may be a mere spoken or written word with no resemblance to color. What content is actually present is irrelevant, if it means the same thing or property. In some cases the content is obviously merely symbolic. The idea of an infinitesimal quantity is not infinitesimal and the idea of contradictoriness is not contradictory. So far from the idea of contradictoriness being contradictory, it involves a demand for consistency. The whatness of an idea involves the whole attitude of the self towards a certain fact. It only approximates at best, as we have seen, in hitting the thatness or the fact. The fact of real non-being must be thought in order to introduce consistency into our judgments of being. The meaning of non-being is precisely the relativity of our meanings. Non-being, therefore, could not be deduced by any *a priori* logic. It can be inferred only *a posteriori*. Owing to the crudity of their logical distinctions, both Heracleitus and Parmenides failed to show the relation of non-being to being.

Besides the conception of dynamic non-being, 'sticking in being' and causing the flux of things, we have in early Greek philosophy the conception of static non-being, external to being. This is the conception of the void or empty space, as opposed to material entities. This conception, made prominent especially by the atomists, was also evolved to account for the apparent changes of reality. Such a conception, it was thought, would make possible the rearrangement or interaction of the permanent entities so as to account for the complex changes of our perceptual world. To the atomist, of course, the conception meant objective reality. It is, however, merely the conception of other being, absolute externality.

In Plato, we find all of the above attitudes toward non-being, besides another, which is typically his own. Perhaps no other concept shows better the complexity of the motives which meet in Plato. Plato cannot get away, somehow, from Heracleitus.

That we live in a world of flux is as obvious to Plato as to Heracleitus and is tinged with the same sadness, though Plato puts the emphasis on the ὅδος, or the eternal truth aspect, and denies the reality of the flux. To transcend the flux, to grasp the rational and eternal, the common and permanent, becomes with Plato an ethical duty. The world of flux is at best a world of semblance, the prison house of the soul.

But in Plato the scientific motive too is strong. He has great admiration for the physicists; and with them he assumes the void or a principle of pure passivity, as opposed to the world of being. The former affords the possibility of generating or mirroring the world of ideas, of which the phenomenal world is the semblance. But even here it is difficult for Plato to keep out the ethical motive. The ὕλη is not pure passivity merely, as is the atomist's void; it seems sometimes to offer resistance to the mirroring of ideas. Negativity becomes a principle of evil. Here the tendency to give non-being positive significance, as another form of static being, becomes even more prominent than with the atomists.

In the *Parmenides*, again, Plato takes the cue from his great predecessor and tries to get rid of non-being by showing its contradictoriness and, therefore, unreality. The one alone is. In the *Sophist*, Plato is unhampered by ethical considerations and considers the matter logically. Here he lays down five fundamental principles: Motion, rest, being, sameness and otherness. Sameness and otherness are here coördinate principles and coextensive with the whole of reality. Non-being here takes the form of other being or diversity, without which thinking is impossible. This, as we shall see, is the modern logical conception of non-being, only that with Plato the conception is metaphysical as well as logical.

Aristotle rejects empty space or the void as contradictory and useless. It is useless because it could be in no relation to being and, therefore, could account for no changes in being. In his discussion of change, however, he gives it a new meaning which is important. The void is nothing but the identity of stuff, or the zero in which opposites meet and pass into each other. It is like the mathematical point, not a positive magnitude. We cannot, however, divorce states from stuff. Hot and cold are in the same matter. The void, then, comes to mean that identity or limit by means of which opposites can interact. In the opposition of qualities through this identity, lies the possibility of change. Of course this limit is not merely an ideal limit, as it would be for us, but a metaphysical limit.

Non-being, however, has a more real significance for Aristotle than this. Affirmation and negation are both attributes of the real. Opposition of judgments is real opposition. In the *Physics*, Aristotle lays down three conditions for change: First, from existence to existence or physical motion; secondly, from existence to non-existence or decay; thirdly, from non-existence to existence or becoming. The latter two cannot be called motion according to Aristotle, as here we have to do with a relation between affirmation and negation, being and non-being. Beside non-being figuring as the limit of opposites, we have it here figuring as the real opposite of being. In Aristotle's concept of the potential and his attitude toward knowledge of the future, which we have referred to elsewhere, we have seen his emphasis of metaphysical non-being and its dynamic significance.

In closing our survey of the Greek attitudes toward non-being, it may be well to say a word about the mystic attitude. This grows out of the mystic definition of being. Being lies outside or beyond the universe of logical definition or reflective knowledge. Our ideas are abstract, partial and many. Reality is concrete, complete and one. Only in our moments of appreciation, in the ecstacy of feeling, when we cease reflecting and lose self-consciousness in the rapture and joy of communion with God, do we attain to reality. But this pure immediacy, which lies beyond thinking, can be nothing at all to thought, is a mere limit. Hence we cannot call it one as over against the many, for this implies thinking. It is mere zero, existence without content, as far as thought is concerned. But to him, who has passed beyond knowledge and lost himself in the larger life, it is fullness of joy and satisfying reality. Here, then, we have a peculiar form of the non-being of otherness, which we found in Plato. It is here the otherness of feeling or immediacy as a limit to thought.

The above may be regarded as a sufficient account of the metaphysical attitudes in regard to non-being. The metaphysical conceptions since may be regarded as reverberations of the ancient. The mediæval contrast of the *universalia ante rem* with the *universalia in re*, or the possible with the actual world, is merely the Platonic contrast between the eternal world and the ideas as mirrored or imitated in the world of generation.

Fichte's idea of the non-ego as posited by the ego is simply Plato's conception of non-being as otherness or difference. The idea of non-being as the irrational limit, as that which offers resistance to ideals or to the rational ego, which we find in Kant and Fichte, is only Plato's conception of non-being as evil over again, with a special ethical significance attached to the process. Hegel's reduction of being as mere immediacy, whether thatness or whatness, to non-being from the point of view of thought; his conception further of *negativität* as the limit, if not the mere identity of opposites and, therefore, making possible the dialectic movement from one category to another in the *Logic;* his launching or objectifying his logical system into the absolute otherness of nature which is made responsible for the distortions and contradictions in the categories, as thus appearing in time and space, — all these are conceptions familiar to us from Greek philosophy, the first two from Aristotle and the last from Plato at least. Schopenhauer's final conception of reality as the negation of individuality and thought, as that state which is nothing to our phenomenal thought world, but from the side of which our world fades away as nothing, is only the ancient mystic conception over again.

B. *The Logical Conception of Non-being.*

In modern discussion the problem of non-being has been transferred, with all other problems, from the realm of naïve objective existence to the realm of logical definition or subjective meanings. The question is not any longer what is the reality of non-being, but how must we conceive non-being or what do our negative judgments mean? This furnishes the proper point of departure. Real necessity and real objectivity must for us be first of all necessity and objectivity of thinking.

The question: What is real? can only be solved through the answer to the question: What concepts must we have, or what judgments must we make, in order to make our experience consistent to ourselves and properly meet our environment? The examination of being and non-being alike, therefore, means an examination of our judgments.

The question of the relation between our affirmative and negative judgments naturally suggests itself. We are not concerned here with the psychological question whether the affirmative type comes before the negative. This question, at any rate, ought not to be settled *a priori*. It might seem as though the affirmative judgment ought to come first and as though the negative must be one stage more remote, as though denial psychologically must have as a background an affirmative judgment or at least a 'suggestion' of an affirmative. If we were always judging consciousnesses, this would be plausible. But the process of judging is comparatively rare. Consciousness dispenses with thinking, whenever thinking is unnecessary; and thinking is only necessary when the conditions are unusual, *i. e.*, when our instinctive or habitual adjustments fail. It would seem, therefore, that our first thinking consciousness is a shock of discrepancy, is negative rather than positive. To be sure it presupposes experience, but not thinking experience, either as a direct affirmation or a suggestion of affirmation. This is a matter at any rate for psychological investigation, not for logical dogmatism, such distinguished authorities as Sigwart and Bosanquet to the contrary notwithstanding.

In regard to the problem, whether all affirmation means negation or vice versa, there has been a similar mixing of psychological and logical considerations. Psychologically considered, the man who means to deny, probably does not mean to affirm; and the man who affirms, does not mean to deny. This is simply the psychologist's fallacy of reading into the state of actual denying and actual affirming the standpoint of the observer, the impartial spectator, whether a later moment or an outside spectator, who is concerned with neither affirming nor denying, who is not dealing with real issues at all, but dealing with the subjective attitudes as such. He sees that the attitude of affirming destroys the other possibilities, whether known to the affirmer or not, and that the attitude of denying must have some reference to truth and, in the case of disjunction at least, does narrow down the possibilities and so affirms. The reference to truth, as we have seen elsewhere, may be merely a reference to a demand for truth, which makes it impossible to affirm a contradiction as final, but does not necessarily mean the reference to a system of truth, though of course sometimes it means that.

The logical question is whether affirmation and negation are really different attitudes, in other words, whether they are equally fundamental. To this question there can be only one answer. When we mean to deny, we mean to deny; when we mean to affirm, we mean to affirm. Let us now inquire a little more specifically into the meaning of our negative judgments and what conception of reality they force upon us.

1. *The Conception of Non-being as Limit or Position, Existence Without Content.* — Such a conception of non-being we become conscious of when we try to define experience which is not of the reflective type. The definition of immediacy must be merely negative, can at most indicate the conditions under which such experience may be had. It cannot give us an equivalent for such experience. The leap, involved in passing from the reflective to the non-reflective type of experience, can only be indicated in thought by zero. This led the Mystics, who regarded reality as essentially non-reflective, to indicate reality by zero.

But even on the reflective level, the beginning of a certain thought consciousness, its continuity with another kind of reflective attitude, as well as with the non-reflective, must be for thought a mere limit or zero. Thought does not account for beginnings, it must take facts as its starting point, it can only systematize that which is. The leap from one kind of thought consciousness to another lies outside or beyond the specific thought attitude which dominates consciousness. Thus to the counting consciousness the preceding non-counting consciousness is a mere limit or zero. One or first is already a step or act in the counting consciousness. In order to mark this off as a step having a similar place in the series to the succeeding steps, we must mark it off from the preceding non-counting consciousness, which thus becomes the limit or zero of the process. The zero of addition, as $n + y = 0$, simply means that numerical value is inapplicable to the facts with which we deal. Thus righteousness and peace $= 0$.

2. *The Conception, of Non-being as Otherness or Contrast or Difference.* — This type of negative judgment has been well discussed by Teichmüller in his *Metaphysics*. We may contrast one grade of reality with another, or we may contrast differences within the same grade. We shall always find, as Plato indicates, that, wherever we can make judgments of sameness, there we can also make judgments of otherness.

We may make the judgment: Circles do not exist, which involves a contrast between the ideal world of geometry and the world of perception; or we may make the judgment that circles are not triangles, which means that one concept is not another. Or we may say that men are not winged, which means that we deny a certain attribute to man on account of other characteristics, which exclude such an attribute. Or we may say that man is not a monkey, which contrasts one class of individuals with another.

We have been dealing with our judgments of non-being merely from the subjective point of view, or with reference to ideal construction, whether in our conception of non-being as limit or as contrast. That one subjective attitude is not another does not denote any lack or negativity on the part of reality itself. In reality there is continuity, not merely conceptual limits. In reality one quality, one concept, or one individual, does not try to occupy the space of another and is not excluded or negated by the other. The more fundamental question arises therefore: Do we have to predicate real non-being, in order to account for the character of such judgments as we have to make in regard to reality?

3. *The Conception of Non-being as Substantial, Dynamic Non-being.* — If we examine carefully the nature of knowledge, we shall find, I think, that it cannot be made intelligible by the presupposition of merely positive characteristics on the

part of reality. I shall merely indicate the reasons here, as they have been dealt with under other heads.

In the first place, without assuming real non-being, the judging process itself would be impossible. The act of judgment presupposes that certain aspects have been torn loose from reality, that some contents, more general and permanent than the rest, have been discriminated and abstracted in the process of experience and have become symbolic of other contents. In a static world, distinctions between thought and reality could never have risen. Consciousness and object would there at any rate be inseparably agglutinated, if there could be consciousness at all in such a world. Judgments are progressive adjustments, which could be possible only in a world which, on the one hand, makes the individual dependent upon centers of reality beyond his own and, on the other hand, through a process of interaction and the survival of the fittest among such adjustments, makes it possible for us to meet, at least approximately, the demands of the other centers upon us and so realize our needs. Judgments, therefore, both as regards their genesis and as regards the testing of their validity, presuppose process and plurality as involved in the constitution of reality. Hence the possibility of judgments presupposes non-being, not negativity in general as an abstract logical category, as Bosanquet has it, but real or dynamic non-being.

But, secondly, we have seen that many judgments or concepts which we have, could become intelligible as regards their own specific meaning, only if we presuppose real non-being. Such concepts or judging attitudes as past and future, we have seen, presuppose real or dynamic non-being in order to have any meaning at all. In human experience, at least, there is real vanishing of content and real novelty. This can only be accounted for by the real transmuting of the structural aspect of the world into ever new significance.

But not only in the historic concepts, which illustrate in a special way the non-being character, but also in our other fundamental concepts we have found that non-being is involved. Thus we found that continuity becomes unintelligible apart from process, apart from the fusing of one positive characteristic or position into another, as for example in the motion of the point to make a line. Positions must be looked upon as secondary abstractions from continuous process. Number presupposes, we found, cumulative process for its significance. So the zero of subtraction in mathematics, as in $x - y = 0$, presupposes at least ideal destruction of possibilities. The concept of the infinite, again, would be impossible except for a thought activity which can abstract from its limitations and thus conceive itself, in obedience to a certain purpose, as creative of new steps, 'world without end.' Even space, the type of the coexistent and the eternal, at least insofar as it presupposes continuity, we found to be unintelligible apart from motion and non-being. And so with other fundamental concepts.

But, thirdly, the incompatibility of our judgments and attitudes, which claim to be of the same (object) and by the same (subject), makes it necessary to suppose that reality at the same point is unstable; that our judgments vary, because they are made of a different reality, and by a different subject; that, in other words, we have different strata or transformations of being at the same point, necessitating different judgments.

At last, then, we are able to place time and non-being with reference to each other and to define one in terms of the other. Non-being, it would seem, is the genus within which time is a species. Non-being, we have found, includes our judgments, both of relative or ideal negation and of absolute negation. The character of time coincides with this latter species of non-being. Time is absolute or dynamic non-being.

This absolute non-being is forced upon us, we have seen, by the instability of the universe, including the universe of truth; it is invented to account for passing away and novelty. Change could not be produced, as modern science seems to imply, by the mere juxtaposition of static entities or substances. We need a negative property, as well as positive properties, to make change possible. We depend upon the nature processes to do the work, we can merely arrange the conditions. But we must not suppose that the conditions, which are our ideal conceptions, are all there is to change.

The function of thought, in the perpetual flux of the universe, must be a directive one. Thought cannot stop the ceaseless processes from working. They work whether we will or no, whether we are awake or asleep, purposive or purposeless. But while thought cannot stop the flux of things, it can give it direction or character by means of its grasp of the meaning of the present and by the proper arrangement of conditions for the untiring nature processes to work out. By the harnessing of the forces of the universe to our purposes, by giving the restless processes the proper grist to grind, we can give meaning to the flux. While things must change, while there must, therefore, be novelty, the quality of this novelty will depend upon the directive meaning we put into the change. In the end the flux will transmute the meanings as well as their objects, the traveler as well as the path; it is for us to say what significance the transmutation shall have, whether purposive or mere chance. Thus we can be creators of a new heaven and a new earth, a new cosmos, instead of allowing the universe to revert to its primitive chaos. Thus we can become masters of the show, prophets instead of mere puppets. In the flux of things the soul can build itself nobler mansions, or, if not nobler, mansions that are more homelike and that better fit its needs. The new wine at any rate requires new bottles, concepts must be remade to fit the demands of a changing environment and a growing consciousness.

In the process of survival, in the history of knowledge, the only demand which has so far proved permanent, is the demand for truth. In the flux of thought this alone has proved *a priori*. In confronting the unknown future, therefore, while recognizing that the process of survival is still going on, we have at least this faith that the spirit of truth shall abide. But this spirit of truth involves a candid recognition of the limitations of truth in the abstract, its dependence upon the larger demand for life, and its subordination, if need be, to this demand.

The Psychological Review

EDITED BY

J. MARK BALDWIN
JOHNS HOPKINS UNIVERSITY

AND

HOWARD C. WARREN
PRINCETON UNIVERSITY

CHARLES H. JUDD, YALE UNIVERSITY (*Editor of the Monograph Series*).

WITH THE CO-OPERATION OF

A. C. ARMSTRONG, WESLEYAN UNIVERSITY; ALFRED BINET, ECOLE DES HAUTES-ETUDES, PARIS; W. L. BRYAN, INDIANA UNIVERSITY; WILLIAM CALDWELL, MCGILL UNIVERSITY; MARY W. CALKINS, WELLESLEY COLLEGE; J. R. ANGELL, UNIVERSITY OF CHICAGO; C. LADD FRANKLIN, BALTIMORE; H. N. GARDINER, SMITH COLLEGE; G. H. HOWISON, UNIVERSITY OF CALIFORNIA; P. JANET, COLLÈGE DE FRANCE; JOSEPH JASTROW, UNIVERSITY OF WISCONSIN; ADOLF MEYER, N. Y. PATHOL. INSTITUTE; C. LLOYD MORGAN, UNIVERSITY COLLEGE, BRISTOL; HUGO MÜNSTERBERG, HARVARD UNIVERSITY; E. A. PACE, CATHOLIC UNIVERSITY, WASHINGTON; G. T. W. PATRICK, UNIVERSITY OF IOWA; CARL STUMPF, UNIVERSITY, BERLIN; R. M. WENLEY, UNIVERSITY OF MICHIGAN; and a special board for the PSYCHOLOGICAL BULLETIN.

THE PSYCHOLOGICAL REVIEW, New Series, is issued in two sections; the Article Section, containing original contributions, appears bimonthly, on the first of January, March, May, July, September, and November, the six numbers comprising a volume of at least 400 pages; the Literary Section (*Psychological Bulletin*) containing critical reviews, notices of books and articles, psychological news and notes, university notices, announcements, and shorter discussions, appears on the fifteenth of each month, and forms a separate volume of at least 300 pages.

Annual Subscription to Both Sections, $4.00 (Postal Union, $4.30); Bulletin alone, $2.00 (Postal Union, $2.20); Single Numbers of Article Section, 50c. (53c.); of Bulletin, 25c. (27c.).

In connection with THE REVIEW there is published annually

THE PSYCHOLOGICAL INDEX

a bibliography of books, monographs, and articles upon psychological and cognate topics that have appeared during the year. The *Index* is issued in March, and may be subscribed for in connection with THE REVIEW, or purchased separately. (*Index* and REVIEW, $4.50 per annum; Postal Union, $4.85. *Index* alone, 75 cents; Postal Union, 80 cents.)

In connection with THE REVIEW there is also published a series of

MONOGRAPH SUPPLEMENTS

consisting of longer researches or treatises which it is important to publish promptly and as units, The *Monographs* appear at irregular intervals and are gathered into volumes of about 500 pages. with a uniform subscription of $4.00 (Postal Union, $4.30). The price of single numbers varies according to the size. Five volumes have already been issued.

Subscriptions, orders, and business communications may be sent direct to Business Manager of THE PSYCHOLOGICAL REVIEW, Princeton, New Jersey, U. S. A., or forwarded through the publishers or agent.

PUBLISHED BY
THE MACMILLAN COMPANY,
41 NORTH QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK
AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St., W. C.);
LEIPZIG (Hospital St., 10); PARIS (76 rue de Rennes).

The Psychological Review,

MONOGRAPH SERIES.

The following *Monographs* have already appeared:

Vol. I.

1. * **On Sensations from Pressure and Impact**: Harold Griffing. Pp. 88.
2. **Association**: Mary Whiton Calkins. Pp. vii+56.
3. * **Mental Development of a Child**: Kathleen Moore. Pp. iv+150.
4. **A Study of Kant's Psychology**: Edward Franklin Buchner. Pp. viii+208.

Vol. II.

5. **Problems in the Psychology of Reading**: J. O. Quantz. Pp. iv+51.
6. **The Fluctuation of Attention**: John Perham Hylan. Pp. ii+78.
7. * **Mental Imagery**: Wilfrid Lay. Pp. ii+59.
8. **Animal Intelligence**: Edward L. Thorndike. Pp. ii+109.
9. **The Emotion of Joy**: George Van Ness Dearborn. Pp. ii+70.
10. **Conduct and the Weather**: Edwin G. Dexter. Pp. viii+105.

Vol. III.

11. **On Inhibition**: B. B. Breese. Pp. iv+65.
12. **On After-images**: Shepherd Ivory Franz. Pp. iv+61.
13. * **The Accuracy of Voluntary Movement**: R. S. Woodworth. Pp. vi+114.
14. **A Study of Lapses**: H. Heath Bawden. Pp. iv+122.
15. **The Mental Life of the Monkeys**: E. L. Thorndike. Pp. iv+57.
16. **The Correlation of Mental and Physical Tests**: C. Wissler. Pp. iv+62.

Vol. IV.

17. **Harvard Psychological Studies, Vol. I.**; containing sixteen experimental investigations from the Harvard Psychological Laboratory: Edited by Hugo Münsterberg. Pp. viii + 654. $4.00.

Vol. V.

18. **Sociality and Sympathy**: J. W. L. Jones. Pp. iv+91. 75 cents.
19. **The Practice Curve**: J. H. Bair. Pp. 70. 75 cents.
20. **The Psychology of Expectation**: Clara M. Hitchcock. Pp. iv + 78. 75 cents.
21. **Motor, Visual and Applied Rhythms**: J. B. Miner. Pp. iv + 106. $1.00.
22. **The Perception of Number**: J. F. Messenger. Pp. iv + 44. 50 cents.
23. **A Study of Memory for Connected Trains of Thought**; E. N. Henderson. Pp. iv + 94. 75 cents.

Vol. VI. (To contain about 500 pages.)

24. **A Study in Reaction Time and Movement**: T. V. Moore. Pp. iv+86. 75 cents.
25. **The Individual and his Relation to Society**: J. H. Tufts. Pp. iv+58. 50 cents.
26. **Time and Reality**: J. E. Boodin. Pp. v+119. $1.00.

* Monographs so marked are not sold separately. Vols. I-III are $7.50 each.

Vol. VI
No. 4

Monograph Supplements

January, 1905
Whole No. 27

THE

Psychological Review

EDITED BY

J. MARK BALDWIN
JOHNS HOPKINS UNIVERSITY

HOWARD C. WARREN
PRINCETON UNIVERSITY

AND

CHARLES H. JUDD
YALE UNIVERSITY
(*Editor of the Monograph Series*)

The Differentiation of the Religious Consciousness

BY

IRVING KING, PH.D.
Instructor in Psychology, Pratt Institute

[Accepted by the Faculty of Philosophy of the University of Chicago in partial fulfillment of the requirements for the Degree of Doctor of Philosophy]

THE MACMILLAN COMPANY,
41 NORTH QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK.
AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St. W. C.);
LEIPZIG (Hospital St., 10); PARIS (76 rue de Rennes).

Vol. VI
No. 4

Monograph Supplements

January, 1905
Whole No. 27

THE

Psychological Review

EDITED BY

J. MARK BALDWIN
JOHNS HOPKINS UNIVERSITY

HOWARD C. WARREN
PRINCETON UNIVERSITY

AND

CHARLES H. JUDD
YALE UNIVERSITY
(*Editor of the Monograph Series*)

The Differentiation of the Religious Consciousness

BY

IRVING KING, PH.D.
Instructor in Psychology, Pratt Institute

[Accepted by the Faculty of Philosophy of the University of Chicago in partial fulfillment of the requirements for the Degree of Doctor of Philosophy]

THE MACMILLAN COMPANY,
41 NORTH QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK.
AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St. W. C.);
LEIPZIG (Hospital St., 10; PARIS (76 rue de Rennes).

Press of
The New Era Printing Company
Lancaster, Pa.

OUTLINE AND ANALYSIS.

PAGES.

Psychologically the religious attitude to be regarded as a specialized form of reaction.
  1. The reaction defined. The problems involved in using it as the basis for the science of religion 1–4
  2. The method of investigating the development of the religious reaction derived from genetic psychology 4

The religious attitude, along with other complex forms of experience, developed from a primitive unspecialized type of reaction 4–9
  1. The nature of an unspecialized experience. 4–6
  2. The sense in which the experience of the natural races of to-day may be regarded as unspecialized............ 6–9

The religious attitude connected in a general way with the intermediiate as against the direct type of reaction.
  Illustrations of simple intermediate activities from among the natural races of the present.......................... 9–10

Two possible avenues of differentiation of primitive intermediate reactions 10–12
  1. Through spontaneous variation.
  2. Through individual initiative.

In either case the variations in custom acquire religious value in portion as they become important emotional elements in the group-consciousness. This may be taken as a working criterion of the extent to which the customs of the natural races are religious, and the extent to which they belong to a pre-religious stage of development.............................. 12–13
  1. Illustrations of pre-religious or imperfectly religious rites among the Australians 13–14
  2. Other aspects of the same among the North American Indians.. 14–20

First steps in the differentiation of the religious consciousness.
  1. Previous theories of, too abstract........ 20
  2. Religion of primitive peoples probably a specialization from their life as a whole. A phase of the development of tribal habit or custom.............................. 21–22
  3. The primacy of the habit and the derived character of the religious attitude.. 22–24

PAGES.

4. Illustrations pointing to the origin of various rudimentary religious attitudes in the customs of primitive races, *e. g.*, notions of sacred places, objects, ancestors, duty self-restraint, reverence, sacred ceremonies, etc. 24–29
5. The importance of the social group in the evolution of these conscious attitudes. Illustrations. Objections answered 29–34

The differentiation of the religious consciousness with relation to magic 34–48
1. Fixed concepts such as that of the supernatural, inadequate as differentiæ 34–37
2. The distinction rather a functional one. Magic developed chiefly in the context of the occasional and individual, religion in that of the more habitual and social 37–41
3. The influence of the context upon the peculiar characteristics evolved by each 41–43
4. The possibility of the fusion of magical and religious practices 43–47
5. Summary and conclusion 47–48

The question of the function of the religious attitude 48–54
1. The nature of the problem of function. Application to religion 48–51
2. The possibility of the absence of the religious attitude in the human consciousness 51–54

The content of the religious consciousness and the causes governing its selection 54–72
1. The nature of the problem and its relation to the genesis of the religious consciousness 54–56
2. The significance of a functional view of experience in the solution of the problem 56–57
3. Summary statement of the reactions which have been held to have religious value; the relation of the grosser to the purer types 57–59
4. The preponderance of the so-called fringe elements of consciousness in religious reactions 59–60
5. The nature and function of the fringe 60–69
   (*a*) The position of Professor James as outlined in the *Varieties of Religious Experience* 61–64
6. The reasons for this preponderance of fringe elements in the religious consciousness 69–71
7. Their true place in religious experience 71–72

THE DIFFERENTIATION OF THE RELIGIOUS CONSCIOUSNESS.

THE NATURE AND CRITERIA OF THE PROCESS.

We propose to state the religious consciousness as a form of reaction in order to relate it more definitely to other types of experience. If such a statement is admissible the various questions that arise with respect to reactions in general, that is as to their stimuli, their development, and their functions, must be answered with reference to the phenomena of religion.

By reactions are meant the simplest elements into which a process of activity can be analyzed. In their simplest form they may be bare responses to stimuli, that is reflexes or tropisms. As the reaction increases in complexity it may not be improper to say that its stimulus is some sort of an unrealized value which the reaction serves to appropriate. The line along which the simplest forms of reaction differentiate is that of the separation of the immediately presented content from the values toward which the activity is directed. Thus intermediate activities gradually arise for more effectively mediating the situations presented. It may be said of them that they have as their end the securing for immediate action of the most favorable influence of the values involved in that action but otherwise not adequately realized in it. The state of consciousness corresponding to these intermediate reactions is primarily simply a recognition of something which lies beyond the present and yet must somehow be taken into account in the immediate activity. The religious consciousness is simply a special differentiation of these intermediate attitudes. If this conception is true there are several corollaries that require examination. In the first place, the religious form of reaction would be hardly distinguishable in the beginning from other forms of activity, and secondly, it would be a differentiation from the life as a whole rather than from any one aspect of it, and thirdly, it would develop as a function of the unfolding experience in which it appeared. These questions will be discussed as we proceed: in the meantime we shall return to the problem of the stimulus referred to above.

The stimuli to these intermediate activities need not be regarded as in any wise different from the stimuli of the more immediate forms of action except that they may be more complex. What is true of the intermediate activities in general is true of the religious reactions in particular. By stimuli to religious reactions are meant the means by which religious emotions, ideas, and impulses are excited; the agencies through which experiences of all kinds which have a supernatural significance to their possessors arise; the means by which all practices of value in subjective or objective forms of worship are initiated. If there is to be a psychology of religion, we must be able to state these agencies, not in terms of a supernatural or transcendental realm, as is generally assumed, both by the practical religionist and also by the philosopher and psychologist, but in terms which shall show that they lie entirely within the world of rationalizable phenomena. This is of course only another way of saying that religion arises as a function of a developing experience.

Stimuli may vary from the simple sensory sort, that is from those that have little or no reference beyond themselves, to complex social situations. These latter, to be sure, are composed of sensory elements and their associations, but they differ from the first because of their organization. From the functional point of view, this variation may be said to be between problematic elements requiring little, to those requiring complex and long-continued reorganization. These problematic elements are functions of the situations in which they occur. Their solution gives a more adequate control over the situations as they are understood. If it is necessary to be more concrete, it may be said that the stimulus on the psychological side stands for a certain modification of experience with reference solely to some sort of activity, simple or complex; it is the psychological correlate of some actual concrete focusing of the environment. Hence the psychologist neither requires nor admits a mystical or transcendental form of stimulus. It is here that the ordinary religionist will be most likely to break with the psychologist.

He may regard his religious experience as a modification of his consciousness, but he is not willing to admit that it is a modification entirely coördinate with other forms of consciousness and produced in exactly the same way. The value of these experiences is not lowered by the mere fact of such a statement unless all experience is thereby condemned. Origin certainly cannot be considered entirely aside from value, but our point is that where all experiences have the same general sphere of origin, that sphere cannot be used to condemn any particular set of them. That is to say, it is true that certain kinds of origin within the natural sphere may be for certain purposes of more worth than others, but the *mere fact of origin* within that sphere cannot of itself be used to condemn an experience.

The question of stimulus may be made clearer by answering the possible objection that if the stimuli of religious reactions are the same as those for other activities, that is, constituted by the same elements, the resulting reactions ought not to be so different. Why does a visual stimulus at one time furnish simply a cue for an immediate reaction, at another time produce an æsthetic state of consciousness, or at yet another time give rise to a religious attitude? The possibility here suggested serves to call attention to a fact, important for the psychology of religion, namely, that it is rare for any two stimuli to be so simple that they can be said with certainty to be the same, and also to the fact that just as the stimulus varies so the organization of the experience that selects it varies. Granted that the same organization of objective factors (*i. e.*, as far as an observer can detect) furnishes a stimulus on two different occasions, it must still have arisen in each case within the same sort of system of conscious elements for the resulting reactions to be entirely alike. It is because the category of stimulus is often isolated from its place as a problematic element in a certain organization of experience that confusion as to its meaning and value arises. It is thus that it has been thought necessary to postulate a supernatural source for those reactions which are felt by an individual to be of the most far reaching significance to himself.

The meaning and value of any stimulus is to be determined solely with reference to the universe of experience within which it occurs. The previous experiences of the individual, in so far as they are organized into present dispositions, combine to determine the reference of the stimulus. Thus it may be said of the act which results from the definition of a certain stimulus, that its ultimate reference, or religious aspect, is determined by the combination of attitudes which have gradually built up about activity with reference to its ultimate organization.

The origin of the religious attitude in the differentiation of experience may be investigated either through anthropology or through child-psychology or even adult-psychology. In fact it is from each of these that we get our *method* for approaching the question in hand. It is largely by projecting what we know of the psychology of individual development that it is possible to interpret the attitudes of primitive races. The fundamental postulate of all studies in social psychology must be that experience differentiates according to constant principles. When it is said that the origin of religion can be investigated by the method furnished by adult-psychology, we have in mind the fact that each reorganization of experience with reference to any problem is entirely analogous to the first differentiations of experience. Since the development of religion is essentially one of the phases of social psychology, it is clear that for concrete detail we must turn to this sphere. But our method is derived from what we know of the psychology of the individual.

Our first point is that religion is a specialization out of a primitive and relatively undifferentiated consciousness. There are many aspects of primitive life that point to its originally simple and unspecialized character. The experience of all primitive peoples even at the present day is very much alike, since the problems that present themselves at these stages of culture are so primary as to vary little the world over. This vague unity of the life of primitive society renders it possible to construct a single psychology of the genesis of religion. Anent this lack of differentiation, the following is of interest: "It has been shown that similar legal institutions and views are found among peoples that are not only distinct in blood but also widely sundered in space, peoples between whom borrowing or transference is absolutely excluded. How is this to be explained? Simply by the similarity of nature and disposition in mankind as such a similarity that asserts itself in certain fundamental traits through all differences."[1] "There exists in every national life an immense stock of common humanity, a very large cycle of customs and views which are the common property of the genus *homo sapiens*."[2] "Whenever we turn in time or in space, to the earliest and simplest religions of the world, we find them dealing with nearly the same objective facts in nearly the same objective fashion, the differences being due to local and temporal causes. This cardinal and basic trust in the unity of action of man's intelligence, which is established just as much for the arts, the laws, and the institutions of men as for their religions, enables me to present broadly the faith of primitive peoples as one coherent whole, the product of a common humanity, a mirror reflecting the deepest thoughts of the whole species on the mighty questions of religion, life, and hope, not the borrowed or isolated opinions of one or another tribe or people."[3] "The nearer we approach the beginnings of civilization, the more do we meet with a surprising agreement in custom, usage, belief, thought, and art."[4]

It would be impossible, in justice to the rest of the subject, to pause here for detailed proof of what is asserted in the above quotations. Their truth will be the more apparent when we reflect that, the fundamental problems of life being the same for all peoples, the experience in which these problems arise must differentiate in ways that are much alike the world over.

If it is true that the vast and varied culture of the most advanced races can be traced back to a culture of an undifferentiated type, we may certainly assume that there was a time when even the elements of primitive culture were not definitely marked off from each other; when the religious attitude, for instance, was indistinguishable from the other overt expressions of primitive mind. We may assume also that when it first appeared it was naturally closely related to the activities that were most constantly at the focus of attention. This is not a very daring assumption for such is the situation as regards religion even to-day with the masses of mankind. The faith of even the culture races is very closely related to the practical problems of the daily life. Thus for many people, the deity is essentially a being for counsel in the difficulties of the day, one who will stay threatened calamity, provide for wants that seem otherwise impossible of satisfaction, one who will restore loved ones to health, avenge enemies and the like. That is, it is because God stands for these benefits that he is worshiped. If this be doubted, let it be noted how rapidly those sects have grown which hold out to their adherents physical health or material prosperity. Nor, if we examine the situation, need we conclude that it is to the discredit of religion. Ultimately all the finest and subtlest elements of our human nature betray their kinship to the life processes in their more primitive form.

---

[1] 'Ethnology and the Science of Religion,' Ths. Achelis. *International Quarterly*, Vol. VI., p. 310.

[2] *Aufgaben einer allgemeinen Rechtswissenschaft*, Post. Quoted by Achelis in the above essay.

[3] Brinton, *Religious Primitive Peoples*, p. 9.

[4] Achelis, *op. cit.*, p. 311.

The two main points thus far are that the religious attitude is at first indistinguishable from many other mediating attitudes, and that it is a specialization from the life as a whole rather than from any one of its elements. Under this latter point we wish to show that it is a *normal differentiation* from practical activities and does not spring from some separate instinct, one bearing no relation to the rest of the life process. We wish also to show that the differentiation is with reference to a more adequate control of immediate values and hence that the form which it takes, the character of its differentiation, is related strictly to the way these values are realized, or present themselves.

That the religious consciousness is at first not definitely separated is evident enough, not only from a study of the remains of primitive peoples but also from an examination of many of the natural races of the present day. On the lowest stages of culture with which we are familiar, man may be said to regard every thing from the religious point of view. Every thing and every act has its religious significance — not, it is true, in the same sense in which it is the case with the modern religionist who does all things 'as unto the Lord,' but rather in that the primitive man is uncertain as to the limits of the religious and the non-religious. Robertson Smith says of the Semites that every act had its religious as well as its social significance. It is because the religious attitude has been regarded as something constant in quality that there has been so much difference of opinion regarding primitive religion. It is maintained, for instance, that the natural races all have at least in rudimentary form the spiritual religion of the culture races; that whether it can be found or not there is everywhere a perfectly definite religious notion, the common element of all faiths. This may be true from the functional point of view, but not in the structural sense in which it is usually intended. We make no supposition here as to whether or not every people must have a religion. The point is rather that it is erroneous to read back the modern attitude, even in attenuated form, into an undifferentiated form of experience.

It is among the Australians that we find to-day the best illustrations of a grade of experience without a definite demarcation of religious consciousness as the latter is usually understood. Of course it is not supposed that the Australian, or for that matter any modern savage, is entirely representative of primitive man. The life of the natural races of to-day is in many ways as highly specialized as is that of the civilized man. The savage is able to make the most complicated adjustments of means to ends within the limits of his own relatively narrow sphere. His psychic processes are not different in kind from those of ourselves. It is chiefly with reference to the complicated division of labor, which is the chief feature of modern culture, that he can be said to have an unspecialized experience. In a certain way, however, we can learn from the savage of to-day something of the condition of primitive man. Much of the complicated life of the modern savage must be regarded as an elaboration of stages of arrested development. It is not necessary to suppose, in other words, because modern civilized peoples probably evolved from some primitive types, that they have therefore in the course of their development passed through all the phases of modern savagery as so many stages. It is rather because they did not pass through them that they attained the civilized level. Talcott Williams[1] points out that the natural races of to-day owe most of their qualities to the pressure under which they live. Primitive man, he holds, may also have been under pressure, but more likely not. If not, it is not at all unlikely that many of the institutions and customs of higher culture should have been very speedily evolved; thus the family, separate ownership of land, and little by little the arts as they were known in the primitive Mediterranean civilizations. He holds that the priest can everywhere claim priority over the warrior chief, and that the war god is never the primitive divinity. Removed from the hard conditions that at a later period assailed the human race, the earliest religion would be one of joyfulness rather than of terror. This view is confirmed by what is known of the religion of the early Semites. Robertson Smith holds that it was one of joy rather than of dread and that the latter type developed only after long series of national disasters. If this view of primitive man is correct, it lends plausibility to the view expressed above that the various degrees of savagery known to us are not so many stages through which the whole race must at one time or another pass but rather that, when the normal development of certain peoples has been arrested by some form of pressure, there has been a subsequent abnormal elaboration of the stage of culture at which their progress stopped. It seems to me that there is little reason to doubt that totemism as it is known to us, cannibalism, various forms of taboo, and the like, are growths of this kind, brought about by some sort of strain or pressure, and if so, it is likely that as we know them they are abnormal growths. The point we wish to press is that, although in the phenomena of savagery of to-day we find highly elaborated forms of reaction, they are elaborations more or less on a dead level, the exaggeration and multiplication of the characteristics of some one stage rather than the elaboration which comes through selection and reorganization for the sake of more far-reaching activity. Therefore in the apparently complicated life of the modern savage we should be able to read between the lines the traces of a truly primitive form of experience.

---

[1] 'Was the Primitive Man a Modern Savage?' Smithsonian Report, 1896, p. 541 ff.

The tribal organization and in general the customs of all the natural races, while very complicated, yet in many ways point to a time when life had not yet developed beyond the first mediating reactions. All that people on these lower stages of culture do has to a large extent its prescribed method. Multitudes of customs cluster about the primitive reactions necessitated by the life process. It is in this matrix of custom that we are to seek the first beginnings of the religious consciousness. Our first problem is to determine the extent to which this body of customs is to be called definitely religious or non-religious and the extent to which parts of it at least point to a prereligious stage of culture.

We have, in a general way, connected the development of religion with the development of intermediating activities; activities, in other words, which arise as the satisfaction of immediate reactions becomes difficult or remote. Manifestly not all such intermediate activities can be regarded as religious. Only an insignificant part of those of the modern civilized man can be so considered. On the lower planes of culture the opposite state of affairs prevails. As has been pointed out already, among some peoples at least, every thing done has a religious side. This condition of affairs is, we hold, a prereligious stage or at least it points to such a stage. It means, first of all, that the objects of satisfaction are no longer to be obtained in the direct unquestioning manner of the brute, but that various things must be taken into account; action must be planned, must be directed in a certain way to affect the most favorable results. Many of the customs of the Malays of Malacca afford excellent examples of that to which we refer. They have elaborate ceremonials accompanying the planting and harvesting of rice, hunting, fishing, and mining, birth, adolescence, and marriage. These practices, it is true, go by the name of magic, but this is only because they are overlaid by a stratum of Mohammedanism.[1] They are the vestiges of very primitive practices designed to render sure some of the satisfactions that had been found to be more or less uncertain. This is certainly the significance of the hunting, fishing, mining and rice ceremonies, at any rate. By the performers they are interpreted of course as having to do with the spirits of these animals, plants or minerals. But the primary emphasis is certainly on the mediation of some practical want and not upon the placating of certain spirits. Spirits are simply the terms used by that stage of culture when it is desired to state the fact that much circumspection is necessary if one is to reach his desired goal. Here are acts that represent the crystallization in custom of the first crude attempts to gain a better control over desired ends. In so far as they are merely this, we hold that they are the product of a prereligious rather than a religious stage of development. Among all primitive peoples we find these efforts to mediate ends. They may on the one hand be said to be akin to the efforts of the modern scientist whose aim is ultimately to render practical activities more adequate, and on the other hand they are related to religion. Our particular problem is to determine how some of these acts lapsed into the non-religious sphere and how others furnished the material for the development of the religious consciousness. We shall first of all try to determine by what criteria a religious practice is to be distinguished from the earlier undifferentiated attitude. We hold that in proportion as these acts become identified with the tribe or group and become the expression of its corporate consciousness, in proportion as they are felt emotionally to be of ultimate significance for the group as a whole, they may be considered religious in the most primitive sense of that term.[1]

---

[1] Skeat, *Malay Magic*, Macmillan, 1900.

The possible ways in which the simplest primitive adjustments could have differentiated are through spontaneous variations preserved through natural selection or through individual initiative. It is not here necessary to raise the question as to whether these two ways belong ultimately to the same type. As regards the first method of differentiation it is certainly possible that many of the practices of the natural races may have accumulated entirely unconsciously and in their origin have been strictly analogous to the variations of the physiological organism.[1] An individual or group of individuals might do something in a new way more or less by chance and this variation would be half consciously or unconsciously preserved in the group through imitation. When this was firmly fixed in custom it would be a part of the tribal religion, as indicated in the preceding paragraph, in proportion as it had a prominent place among the activities of the tribe. As far as acts of this type are concerned, the only criterion of their religious value would be the extent to which the group consciousness was identified with and expressed in them. The more important their part in the preservation of the group and its accustomed activities, the more fully would they approach to the religious type as it is first demarcated. The mining and fishing customs of the Malays may very well have originated in this way. They impress one as perpetuations of the merest chance associations. Thus there are taboos on killing animals in or near the mines, against taking umbrellas, or wearing shoes or a certain kind of coat into the mines. There is also a sacred language which must be used while working the mines, the common language being tabooed. These customs can hardly be called religious. They are simply accumulated habits transmitted from generation to generation or from one people to another, the *ways* these particular things were to be done. That is, another tribe on undertaking to mine tin would imitate every detail in the method of those who first did it, even to such irrelevant details as those of language and dress. The mere fact that spirits were involved in their interpretation of the practices is no indication that they were religious. The spirits were simply ways of expressing the idea of force that is familiar to the civilized man.

---

[1] This is the position taken by W. Robertson Smith, but it is, as we shall see later, seriously disputed by Brinton in his *Religions of Primitive Peoples*. See page 29 f. of this thesis for discussion of point.

We should refer in this connection to the proposition of Brinton that the underlying assumption of all religion is "that conscious volition is the ultimate source of all Force." In other words "that behind the sensuous, phenomenal world, distinct from it, giving it form, existence, and activity, lies the ultimate, invisible, immeasurable power of Mind, of conscious Will, * * * and * * * *that man is in communication with it.*"[1] This postulate is, as it seems to me, far too general to meet the requirements of a definition. The postulate of Mind as back of everything and that man is in communication with it, does not of itself make his attitude a religious one more than is ours with its more abstract notion of force or energy which we can in a degree control. It is only as this interpretation controls the life in some fundamental way that it becomes religious. It must be the organizing principle beneath our deepest emotions and impulses, must, as it were, become a subconscious agency in the determination of the greatest crises of life. The notion that conscious mind underlies the phenomena of nature and human destiny, if it is abstracted from this setting, is simply the crude postulate of a primitive intelligence, and we hold that the attitude which gives it a true religious significance may very well exist without the notion, or at least without its having the significance that Brinton attributes to it. As we shall try to show, this or any other notion may acquire a religious value most readily in the environment furnished by the social group, and it is from this point that we shall argue for the essentially social character of primitive religion.

---

[1] For an interesting parallel to this on the side of language see 'The Biological Evolution of Language,' *Monist*, July, 1904.

We turn now to the consideration of the second source of the complexity of primitive custom, namely, the initiative of the individual in the reconstruction of a problematic situation. This possible source of variation, while probably the most important one, would never be entirely unrestricted, for as man became with growing intelligence, more able to reconstruct in the face of difficulties, yet the previous body of effected adjustments which had accumulated in the form of group habits, would tend increasingly to inhibit new adjustments or variations.

It is through individual initiative that we can most easily account for many of the most painful and fantastic practices of primitive man.

Let it not be forgotten that we are seeking criteria for determining whether particular practices of primitive peoples are religious or strictly speaking prereligious. We have held that where every act is regarded with circumspection the religious attitude has really not been definitely separated. Of the complexities in action arising from the unconscious accumulation of more or less chance variations, the only criterion seems to be the extent to which the tribal consciousness has identified itself with them. Likewise, of the complexities that result from the efforts of an individual to meet a situation which resists his habitual methods of reaction, those only are religious which are fully absorbed in the corporate life of the group. Therefore, whenever we find a social level at which many of the ceremonies are in the control of individuals, or small groups of individuals, not as priests, but as private owners, we hold that the practices are in so far of the prereligious type. Among the Arunta tribe of Central Australia certain individuals or small groups of individuals apparently own ceremonies and have the exclusive right to perform them.[1] And yet they are performed by these individuals for the tribe or group and at their instance. Thus when the quantity of some plant or animal is to be increased, the totem group corresponding performs the proper *intichiuma* ceremony designed for that purpose. These ceremonies have developed in connection with their naturally strenuous food conditions. In the face of some particularly trying food problem some ingenious individual would possibly try something to effect relief. They are simply schemes for supplementing the deficiency of the direct food reactions. "Their performance is not associated in the native mind with the idea of appealing to the assistance of any supernatural being."[2] Their kinship to religion, however, is revealed by the fact that, in spite of their being the property of individuals, they are nevertheless performed for the tribe so that they have a distinct social aspect.[3] Going still farther than this, we sometimes find in the possession of a single individual particular circumcision or initiation rites.[4]

---

[1] *Religions of Primitive Peoples*, p. 47.

---

[1] *Native Tribes of Central Australia*, Spencer and Gillen, p. 226 et al.

[2] *Ibid.*, p. 170. For general description of the ceremonies, *vide* 167–211.

[3] *Ibid.*, pp. 202–211. That they have also an individual aspect, *vide ibid.*, 190 ff.; 199.

[4] *Ibid.* "The *Quabara* (sacred ceremonies), which are performed at these initiation ceremonies, vary according to the locality in which they are being performed, and the men who are taking a leading part in them. * * * Each old man who presides over, or takes a leading part in, a ceremony such as this has

Rites of this sort are elsewhere usually found as purely tribal regulations, that they are not fully such in this instance indicates that the products of individual initiative have not as yet been fully identified with the tribal consciousness. Or perhaps in some way the normal development was arrested before there was a well organized social group, so that at present the line between the social and the individual would be somewhat uncertain. If we are able to show later that primitive religion is essentially a matter of the community rather than of the individual, we shall be in a position to hold it as quite probable that in these Australian practices we have the remnants of a primitive undifferentiated consciousness in which the religious as such had not definitely appeared.

A different aspect of the same thing is to be found among certain of the tribes of North American Indians. That is, although it is not the individual but the tribe which possesses the ceremony, it is traced back to some mythical or traditional individual through whose initiative or adventures the ceremony was secured and turned over to the tribe. Tradition, in other words, preserves suggestions as to the origin of the current religious practice in

---

possession of a certain number of *Quabara*, and naturally those performed are chosen from this series as they are the ones he has a right to perform" (p. 226).

With regard to the initiation ceremonies in general we find the following: "Each totem has its own ceremonies, and each of the latter may be regarded as the property of some special individual who has received it by right of inheritance from its previous owner, such as a father or elder brother, or he may have, in the case of the men who are supposed to possess the faculty of seeing and holding intercourse with the *Iruntarinia* or spirits, received it as a gift directly from the latter, who have at some time, so he tells his fellows, performed it for his benefit and then presented it to him. This means either that he has had a dream during which he has seen a ceremony acted, which is quite as real a thing to him as actually seeing it when awake, or that being of a more original and ingenious turn of mind than his fellows — as men skilled in magic certainly are — he has invented it for himself and has then told the others, who implicitly believe in his supernatural powers, that the spirits have presented it to him" (p. 278). "There does not appear to be anything like a special series which must of necessity be performed, and the whole programme is arranged, so to speak, by the leading man, whose decision is final, but who frequently consults with certain of the other older men. He invites the owners of the different ceremonies to perform them * * *." "The man to whom the performance belongs may either take part in it himself, or, not infrequently, he may invite some one else to perform it, this being looked upon as a distinct compliment" (p. 279). *Vide* also pp. 334, 341, 413, 416, *et al.*

the prereligious mediating activities of an individual. In many cases the identification of the practice with the tribe has not been completely effected, the different ceremonies remaining in the possession of secret societies. The analogy betweeen these secret societies and the denominations of Christendom is interesting and is of more than passing importance.

The secret societies and ceremonies of the Kwakiutl and allied tribes in the Northwest furnish abundant illustration of these points. The bear clan, for example, was founded by a man who fell in with a bear while hunting mountain goats. The bear taught him how to catch salmon and how to build canoes. When he returned to his people he looked like a bear but was gradually retransformed. "After this, whenever he was in want, he called his friend the bear who came to assist him. In winter when the rivers were frozen, he alone, was able to catch salmon. He built a house and painted a bear on the house front, his sister made a dancing blanket the design of which represented a bear. Therefore the descendents of his sisters use the bear for their crest."[1] The following legend is from the Bilxula, a tribe also of the North Pacific coast. "The sisauk·, which is danced at potlatches and other festivals of the clans, is presided over by a being that lives in the sun. A man who had gone out hunting met the sisauk· and was instructed by him in the secrets of the dance. When he returned he asked the people to clean their houses and to strew them with clean sand, before he consented to enter. He then danced the sisauk·, and told the people what he had seen."[2] These stories are typical of a large class, in which the ceremonies of a clan or totem are traced to an ancestor, who, in some way obtained them or magic powers.[3] It seems to me that the possession of a ceremony by a secret society, is a step in the development of the religious attitude intermediate between a genuine tribal religion and the prereligious stage. These further details of the sisauk·, point partly to its religious character and partly to its imperfect absorption by the social group. "Each clan has its peculiar carvings which are used in sisauk· only, and are otherwise kept a profound secret, *i. e.*, they are the sacred possessions of each clan. * * * Every time the sacred objects of a clan are shown to the people, a potlatch is given. The sacred objects, although the property of the various clans, must nevertheless be acquired by each individual, that is to say, every free person has the right to acquire a certain group of carvings and names, according to the clan to which he or she belongs. Slaves and slaves' children, also illegitimate children, cannot become sisauk·. A person cannot take a new carving but must wait until it is given to him by his relatives."[1]

---

[1] *The Social Organization and the Secret Societies of the Kwakiutl Indians* Franz Boas, Report of the U. S. National Museum, 1895, p. 323.

[2] *Ibid.*, p. 647.

[3] *Ibid.*, p. 414 ff.

The individualistic character of some of these practices comes out in the following. "Each man among these tribes acquires a guardian spirit, but he can acquire only such as belong to his clan. Thus a person may have the general crest of his clan and, besides, use as his personal crest such guardian spirits as he has acquired."[2] A single individual may own a dance and another may obtain it by killing him.[3] There are other and more regular ways of acquiring a right to some of these ceremonies. "As might be supposed from the laws governing the clan system, the 'dance' is principally acquired through marriage. Together with the house, the carvings, and the names of the father-in-law, the young man obtains his dance name and *quequtsa* name, but not for his own use. They are given to his successor who is initiated in the prescribed way and then performs the ceremony. But the son-in-law of the former owner controls the dance. It can be shown only with his consent, and, when another man marries his daughter, he may take it away from his successor and give it to this person, who then owns and controls it."[4] The transfer of a dance to a son-in-law is made a distinctly social affair. The clan is called together and told by the father-in-law what is to be done. They offer their assistance if it is needed. At the end of the ceremony there is a distribution of property among the members of the tribe.[1] The private ownership of the rites on the one hand and their intimate connection with the social consciousness of the clan or tribe indicates, to my mind, that these practices are the vestiges of an imperfectly evolved religious attitude. We shall, however, defer the discussion of this point until a few more examples have been given.

---

[1] *Ibid.*, p. 647.

[2] *Ibid.*, p. 323.

[3] *Ibid.*, p. 424.

[4] *Ibid.*, p. 421. The method of acquiring dances is described at length in the pages that follow.

Among others of the North American Indians we find apparently higher stages in the development of ceremonials which were probably of individual origin, but which now belong definitely to a secret society or to the entire tribe. Thus the Snake Dance of the Moqui is conducted by a secret society although it belongs theoretically to the whole tribe. It must belong to the type of intermediate practices that are to be traced to the initiative of some individual. To some primitive Moqui the rattle-snake situation must have presented itself so acutely that for the purpose of meeting it he devised the first crude beginnings of this ceremony. The avowed purpose of the ceremony to-day is to 'conciliate the snakes so they will not bite their children.'[2] The interesting feature for us here is that although in a way it is private, it is performed for the entire tribe. Whenever a member of the tribe is bitten by a snake he appeals to a member of this order. It is easy to see in this ceremony the elaboration of purely practical intermediary activities. This connection is not so evident in the case of the Kwakiutl. With the latter it looks as if the ceremony making habit had gotten detached from the practical tensions in which it originated and went on developing independently.

The Mountain Chant of the Navajo[3] represents still another stage in the development of a practice, at first private, into a genuine religious ceremony. It is based on an elaborate myth regarding the migrations of a family, the escape of a son from the hostile Ute, his protection and succor by various gods and animals until he reaches his kindred. At one place in his return home he enters the abode of the gods or supernatural animals who show him how to prepare the sacrifices, or sacrificial sticks, to each of them; he is initiated into various religious rites with the injunction that these be communicated to his people. Each important feature of the present ceremony is thus learned, *e. g.*, the sand paintings. It is immaterial whether this myth is explanatory of the rites or whether the rites are dramatizations of the myth. Some parts of it are clearly of the explanatory type. Thus, the races and betting described in it explain to Navajo how their tribe happens to be richer than its neighbors. Other portions of the story may quite possibly have preceded the ritual. But in either case it is significant to note that the origin of the Chant is connected with the adventures of an individual and in this way its kinship with the less completely socialized ceremonies of the Kwakiutl is revealed. That it is more fully religious in character, the following seems to indicate. It is of nine days' duration, and must be celebrated in winter when the thunder is silent and the rattle-snakes hibernating. A shaman, or medicine-man, is master of ceremonies. Its ostensible purpose is to cure disease, but it is also the occasion for invoking the unseen powers in behalf of the people at large for various purposes, particularly for good crops and abundant rains. We should also include in its purposes the perpetuation of religious symbolism. The dramatic and play spirit enters largely into it. The merely social function is extremely obvious. "It is an occasion when the people gather to have a jolly time."[1] In the minute observance of detail it involves, in the festive character of the whole, and in its purposes is evidenced its religious character.

---

[1] *Ibid.*, p. 422 ff.

[2] *The Snake Dance of the Moqui*, Bourke, p. 177.

[3] Fifth Annual Report of the Bureau of Ethnology.

The Indians of the plains[2] seem to represent a stage of arrest even lower than that of the tribes of the Northwest. Here also there are many ceremonials but each of them not only is in the possession of an individual but was originated by its possessor and not by a mythical ancestor as with the tribes referred to above. The ceremonies have professedly been revealed to their owners, chiefly in dreams, and the paraphernalia for carrying them out is private property and may be sold, but the right to perform the ceremony passes away with the accessories. They are performed under the direction of the owners and by them chiefly, many in the tribe paying little or no attention to the rites. This condition is probably accounted for by the loose social structure of the Plains Indian tribes. Their shifting wandering life has apparently prevented the construction of the elaborate social organization that is characteristic of the tribes that rove less widely.[1] Hence there is no chance for the practices initiated by the individual becoming an avenue for very much social expression. If some of these ceremonials could only get embodied in the social structure they would probably tend to inhibit the indiscriminate production of ceremonies on the part of the individual. In so far as these practices are religious they represent a development of that attitude independent of the assistance of the social organization. We find the same individual subjectivism among the Algonquin in the fact that every youth seeks in fasting and isolation a revelation that will make him a medicine man, the possessor of a manito and hence a dispenser of ceremonies.

---

[1] *Ibid.*, p. 386.

[2] I am indebted to Dr. Clark Wissler of the American Museum of Natural History for these facts regarding the Plains Indians. The interpretation is my own.

The most that we can hope to do in the investigation of the first steps in the evolution of the religious consciousness, is to find here and there, in the midst of more highly developed attitudes, the vestiges of the less specialized stages. If it is true that the modern savage in any sense represents various phases of arrested development and subsequent abnormal growth at the levels of arrest, it would seem possible, theoretically at least, to find in savage culture remnants of the beginnings of our highly specialized forms of reaction. The practical difficulty with such a procedure is, of course, the fact just referred to of the development of these detached stages on a dead level. They give us the impression of being highly developed forms of reaction of the same sort as those of the culture races. As a matter of fact they are merely mechanical accumulations about some crude adaptation of means to end rather than, as with ourselves, the complication that comes from a more and more rigid working out of the means for reaching increasingly complex goals. We have, on the preceding pages, pointed out some indications in savage life of a very early if not a prereligious attitude. In order to do this we have of course had to set up some sort of a standard by the side of which various practices could be called more or less highly developed. We have assumed, not entirely gratuitously, that the religious consciousness first found definite expression in the atmosphere furnished by a social group. The legitimacy of this conception will be more evident when we have considered some of the steps in the definite demarcation of the religious attitude.

---

[1] This seems to be generally true of the roving Indians. A. F. Bandelier says of the Apaches, 'Of their creed and belief almost nothing can be gathered from older sources beyond the fact that their idolatry was not as complicated and as thoroughly systemized as that of the sedentary Indians.' Papers of the Archeological Institute of America, III., Final Report, 'Investigations among the Indians of the Southwestern United States,' p. 183.

It is scarcely necessary here to give an extended argument against the various theories that have traced the origin of religion in a supposed impulse of primitive man to solve the mysteries which surrounded him, or in an imagined speculative curiosity conceived as stirring in the breast of the savage. Of the remote period to which we must go with such an inquiry, Marillier says:[1] "Speculative curiosity is not yet aroused, and man seeks to find only what he needs for practical purposes to know." We need here drop only a word concerning Mr. Spencer's ghost theory of the origin of religion. According to it primitive peoples were acutely conscious of the mystery of life and death and from the phenomena of sleep, dreams, fainting, trances, and of death itself, they constructed a theory of a spirit world and therewith devised means to propitiate it. From the point of view here presented, this theory is to be criticized for conceiving religion as fundamentally an attitude with reference to spirits, and for attempting in consequence to trace its origin to a single problem of primitive life, and thus failing to recognize in it an aspect of this life which was gradually set off as a distinct attitude only when the whole life became more and more complex. The theory also presupposes a general development of consciousness and, in particular of the speculative interest, such as a more extended study of the natural races has not warranted our assuming.

---

[1] 'The Objects of Primitive Worship, *International Monthly*, November, 1900, p. 459.

In view of the fact pointed out by W. Robertson Smith to which reference has already been made, a fact recognized by almost every ethnologist,[1] namely, that every act of primitive races had something of a religious value, it is safer to seek the origin of religion in certain aspects through which experience as a whole has passed in the course of its normal development. This suggests the close relationship between the development of religion and habit. It has often been pointed out that religious phenomena grow largely out of the field of the subconscious, or the fringe.[2] In a later section of this thesis, the psychological problems here involved will be discussed. Here we wish merely to state that the subconscious and habit, are practically identical. Without doubt the most fundamental category in the development of the religious consciousness is that of habit. It is through the psychology of habit that we explain the conservatism of the religionist, his attitude of reverence, his feeling of the authority of his mental states. The accumulation of habits in various directions is one of the first steps in the evolution of religion. There are first direct adaptations of the simplest means to the most immediate ends. Then, as these immediate ends become in various ways remote and problematic, intermediate adjustments are set up, and these, as they are fixed in the habit of the individual and in the custom of the social group, begin to have religious value. It is important to note that these habits may, and do arise with reference to any and all the activities of life. When there is an effort to gain control over things, or to reach ends immediately desirable, and the reaction falls apart because of unforeseen or uncomprehended obstacles, so that a different adjustment of the resources at hand is desirable, when for instance the needed rain does not come, when the sought-for watercourse or spring is not found, or is found dry, when the game eludes the hunter, when disease strikes down the strong men, then arises the consciousness of the need for some sort of mediating reactions. Or again if the habitual methods of obtaining food or of seeking protection from enemies, of meeting the crises of birth, of coming to maturity, marriage, death, etc. (and habitual courses of action in all these cases we must regard as inevitable) — if, we repeat, any of these habitual activities is in some way checked, either by external forces or through the delinquency of some member of the group in whom the habit was not so firmly fixed, we can certainly suppose the same uneasiness in the group, that we ourselves feel under like circumstances. The value of a habit would especially come to consciousness, if some untoward event should occur when the uneasiness of the break was acutely present in attention. Thus if the game that was not hunted in the usual way escaped, the uneasiness of the broken habit would be connected at once with the disappointment in the loss, so that the habitual would be felt as authoritative, precisely as with ourselves in similar conditions. This power of the habitual is certainly one of the most important elements in the religious consciousness in all its stages of development.

---

[1] Cf. Bandelier, 'There is of course a great deal of superstitious practice connected with all these performances (of the Pueblos), for the Indian is so fettered to his complicated creed that his most insignificant actions are associated with some ritualistic performance.' *Papers of the Archeological Institute*, III., p. 161.

[2] Cf. Brinton, *Religions of Primitive Peoples*, p. 84.

The formation of these group, habits together with their effects in consciousness when interrupted, contributes to the differentiation of a special class of individuals for maintaining group habits. There would inevitably be some persons in the community who would feel more acutely than others the value of the customs and consequently the necessity of faithfully preserving them. Among the Central Australians the old men as a class have acquired this special function. In the various problems that arise in the effort to maintain custom, we may trace the forces that contribute in important measure to the differentiation of both priests and chieftains. The prowess of particular individuals also tends to give them a prominent place in the attention of others, so that their words are received with respect and even authority, and their deeds are regarded as of wider import than those of the ordinary tribesmen. It is certainly clear that from practically every aspect of the ordinary life-activities of primitive peoples there is opportunity for the genesis of a sense of a more ultimate organization of activity than that directly involved in immediate processes. According to perfectly familiar psychological laws the necessity of making intricate adjustments for the attainment of practical ends is more and more recognized, and the character of the mediating adjustments that actually arise are of course as fantastic and as irrational as the experience in which they appear. They are naturally determined by association by contiguity in its crudest forms. That which attracts attention at a moment of tension is immediately considered as important, and something to be taken into account in dealing with the crises of similar nature in the future. Whatever is associated either habitually or in a striking way with a people or an object of any kind must thereafter be taken into account in all dealings with them. We have here the basis for the formation of any sort of habit or practice that can well be imagined. This is the ground of the individual and group variations that we have already discussed at length.[1] The inevitable crystallization of all activities into habits and the mental concomitants of their violation, furnish the basis for that sense of authority which is such an important element in every religious state of mind. The point of view, which is here presented, regarding the development of the religious consciousness is analogous to that of Professor J. H. Tufts concerning the relation of the æsthetic consciousness to art. It "is not that of cause, but that of effect. Art has not arisen primarily to satisfy an already existing love of beauty. It has arisen chiefly, if not wholly, from other springs, and has itself created the sense by which it is enjoyed."[2] "The dance before the chase or battle, the mimes at agricultural festivals, or at initiation ceremonies, which seem to the uninstructed onlooker crude forms of art, are to the mind of the actors entirely serious. They give success in the real activities which follow these symbolic acts. They bring the rain or sunshine or returning spring."[3] We hold that a similar thesis is true of the genesis of religion. The life of the primitive man differentiates into various, to him, practical activities and these, under certain circumstances, produce the states of consciousness that later are detached from the acts and held to be religious. The development of the habits is the pre-condition of the evaluating states of consciousness, not the result of them. When the religious states have begun to appear, the habits may be said to have become rituals and the stories and traditions, religious myths. Brinton[1] lays a great stress upon the difference in the mind of the savage between a genuine myth of the gods and a mere story told for passing amusement. He holds that the myth is the product of man's groping religious sense, and that the ritual is a mimicry of the myth.[2] In disagreeing with Brinton we are not therefore bound to accept as an alternative the view of W. R. Smith which he refutes, namely, that the ritual produces the myth. Myth and ritual may well be originally independent growths, each in the same manner acquiring religious value. This would not preclude the possibility of their later coming together and each contributing to the growth of the other, as they no doubt have done. As a result we may have myths that explain religious rites and religious rites that have arisen to explain and make more vivid to the savage mind the details of the sacred story. Our point is simply that each was originally a form of social habit and in that way attained religious value, or produced the states of mind that have so often been regarded as their cause.

---

[1] *Vide* p. 10 ff.

[2] *On the Genesis of the Æsthetic Categories*, The University of Chicago Decennial Publications, Vol. III., Part 2, p. 5.

[3] *Ibid.*, p. 8 ff.

We purpose now to examine more in detail the development of religion from tribal habits.[3] The Central Australians furnish excellent illustrations of habits which have religious value and yet are clearly practical adjustments or postulates which originally, if not at present, were accompanied by no marked evaluating attitudes. All the present customs of these tribes are by them traced to their ancestors, the *Alcheringa*, who are venerated, not as spirits or gods, but rather because they furnish the basis for the present institutional life. "To the mind of the Arunta native the idea of the possibility of any thing before the *Alcheringa* was a ridiculous and incomprehensible one." 'It was so in the *Alcheringa*' is the final answer with regard to all questions as to the origin of their customs.[1] Associated with their ancestors are the *Churinga*, or sacred objects.[2] These play an important part in many of their ceremonies and must never be seen by the women, "* * * in connection with the *Churinga*, there are among the Australian natives beliefs which can have had no origin in fact, but which have gradually grown up until now they are implicitly held. It is necessary to realize this aspect of the native mind in order to understand the influence which some of their oldest and most sacred beliefs and customs have upon their lives."[3] The *Churinga* are kept in secret repositories, or *Ertnatulunga*, which seem to be embryonic sacred places.[4] Their whole system of beliefs seems to be a merely mechanical accumulation of habits. First there are the ancestors who began to do things the way they are now done. Associated with them are the *Churinga*, which derive their sacredness from this association, and in general from the body of habits which has gradually been gathered about them. Then there are the storing places of the *Churinga*, which are sacred for the same reasons. These depositories, or *Ertnatulunga*, may also be regarded as rudimentary cities of refuge. Everything in their vicinity is sacred. A man pursued by others would not be touched as long as he remained in one of these spots. So also the wild animals, when they chance to run there, become taboo.[5] Specific ceremonies must prepare a man for seeing the *Ertnatulunga* for the first time. He must have passed through the various initiation rites of the tribe, must in addition "show himself capable of self-restraint and of being worthy by his general demeanor to be admitted to the secrets of the tribe. If he be what the natives call *irkun oknirra*, that is light and frivolous, and much given to chattering like a woman, it may be many years before he is admitted to the secrets."[1]

---

[1] *Op. cit.*, pp. 112f., 117.

[2] *Op. cit.*, p. 173.

[3] Professor G. A. Barton, in his *Semitic Origins*, confirms in a striking way the view here taken of the evolution of the religious consciousness. He shows that the development of Semitic religion was strictly conditioned by the form of Semitic social life. Primitive society among these peoples was organized on a matriarchal basis with accompanying polyandry. This was a result of their peculiar food conditions. As long as these conditions held the Semites had female deities and religion in general was of the phallic type. When society shifted to a patriarchal basis, the religion changed and the deities were transformed accordingly. Their religious conceptions, in other words, grew directly out of the primitive problems of food and reproduction. The evidence adduced by Dr. Barton is so striking that it deserves a large place in our argument, and yet on account of its detail and extent it seems best to simply refer to it here. If I have correctly interpreted this work it goes to prove that as far as the Semites are concerned, religion evolved from certain aspects of social habit, or custom, which was, in turn, determined by the way the fundamental life problems presented themselves at various stages of their life.

---

[1] Spencer and Gillen, *op. cit.*, p. 136 f.

[2] *Ibid.*, p. 128 ff.

[3] *Ibid.*, p. 130.

[4] *Ibid.*, p. 133.

[5] *Ibid.*, pp. 134, 135.

The notion of the sacredness of the *Churinga* is evidently based upon the intimate way in which they are associated with the traditions and ceremonies of the tribe. Their loss is the "most serious evil that can befall a group."[2] The elaborate ceremonies which are enacted at the loaning and at the return of these sacred objects[3] are excellent illustrations of the way in which complicated system of habits can gradually accumulate and acquire the same authority and sanctity that obtains in the sacred rituals of more highly developed religions. The point of this illustration for us is that there is here an exaggeration of a very early step in the development of the sacred from the merely habitual. It seems to me that the basis of their worth is here and not in the fact that the notion of spirits is involved.[4] In connection with the secret names[5] and the initiation ceremonies[1] the same notions of sanctity appear.

---

[1] *Ibid.*, pp. 139, 140.

[2] *Ibid.*, p. 135.

[3] *Ibid.*, p. 159 ff.

[4] The *Churinga* do not contain the spirits of their ancestors, but are simply associated with them. Whenever one of these spirits enters a woman for reincarnation into a child it drops its *Churinga*. (*Ibid.*, p. 132.) "At the present day the Arunta native does not regard the *Churinga* as the abode of his own spirit part, placed in the *Ertnatulunga* for safe keeping. If anything happens to it, if it be stolen, he mourns over it deeply and has a vague idea that some ill may befall him, but he does not imagine that damage to the *Churinga* of necessity means destruction to himself. In the native mind the value of the *Churinga*, at the present day, whatever may have been the case in past time, lies in the fact that each one is intimately associated with, and is indeed the representative of, one of the Alcheringa ancestors, with the attributes of whom it is endowed. When the spirit part has gone into a woman, and a child has, as a result, been born, then that child is the reincarnation of that particular spirit individual" (*Ibid.*, pp. 137, 138).

[5] "Every member of the tribe has his or her secret name. This secret name is never uttered except upon the most solemn occasions when the *Churinga* are being examined, and that of any particular individual is known only to the fully initiated men of his own local totem group. To utter such a name in the hearing of women or of men of another group would be a most serious breach of tribal custom, as serious as the most flagrant case of sacrilege amongst white men" (p. 139).

It would perhaps be safe to say that their ideas of spirits are merely coördinate with these other tribal habits, at least as far as they are related to the differentiation of the religious attitude. They are certainly not basic. We may repeat here a statement previously made regarding the *Intichiuma* ceremonies (those held for increasing the supply of the totem animal or plant) that "their performance is not associated in the native mind with the idea of appealing to the assistance of any supernatural being."[2] The existing social group is composed partly of corporate individuals, and partly of invisible spirits which are called in general *Iruntarinia*, beings indistinguishable from the spirit part of the Alcheringa.[3] There is thus among them no belief in animism as it is generally understood, but only in spirit individuals more or less friendly, and related to themselves in a very real sense.[4] The belief in these spirit individuals is of course coördinate with the more common animism of other primitive peoples. In this, as in the case of animism, there is nothing intrinsically religious. Both this and the animistic hypothesis exist for the purpose of explaining the unwonted; as much at least is clear in the appended reference regarding the belief in the *Iruntarinia*.

---

[1] Regarding the initiation ceremonies, "the main object of this partial seclusion is to impress him with the fact that he is about to enter the ranks of the men, and to mark the break between his old life and the new one; he has no precise knowledge of what is in store for him, and the sense that something out of the ordinary is about to happen to him — something moreover which is of a more or less mysterious nature — helps to impress him strongly with a feeling of the deep importance of compliance wtth tribal rules, and further still with a strong sense of the superiority of the older men who know, and are familiar with, all the mysterious rites, some of which he is about to learn the meaning of for the first time" (p. 223).

[2] *Ibid.*, p. 170.

[3] *Ibid.*, pp. 512–515.

[4] "The *Iruntarinia* are supposed to have their likes and dislikes as regards the human members of the group to which they belong. Some men who are popular amongst them will often be followed as they go out hunting by perhaps two or three of the spirit people who will assist them by driving prey toward them. * * * If a man be out hunting and has his eye fixed on his prey, and for some reason, apparently without any cause, he suddenly looks down and sees a snake just where he was about to tread, then he knows at once that his *Arumburinga* (one of the *Iruntarinia*) is with him and prompted him to look down suddenly" (p. 514). "It is, so the natives say, no uncommon thing for a man to wake in the morning, or even after a sleep in the middle of the day, and find that his spare string has disappeared. He looks around for tracks, but finds none, and at once concludes that the *Iruntarinia* have been visiting him. He must not be angry or else he would offend them, and moreover, he feels that his *Arumburinga*, who has most likely taken the string, needed it for some special purpose, and will return it safely when done with" (p. 516).

It will be noted that we have not referred to the common notion that religion develops primarily from the awe inspired by the unusual, from which the idea of the supernatural is first formed. We have held that a religious act of any kind is primarily a practical act designed for the mediation of an end that has become remote or difficult, and that the genuine religious character develops most fully as the act is fixed in the customs of a social group and becomes an important avenue for the expression of the corporate life of the group. In such a way, it seems to me, the notion of sacredness arose, and with it respect, awe and reverence in the religious sense. The notion of the supernatural may well have originated in the way suggested at the head of this paragraph but it is not a fundamental concept in the development of religion.

We have of course no right to generalize from the Arunta tribe of Central Australia that the belief in spirits is not a primary one in the original differentiation of the religious consciousness, but the case of the Australians, granted of course that they have been correctly interpreted, certainly gives us the right to raise the question as to whether too much stress has not hitherto been placed upon animism.[1] Mere animism can hardly be called primitive religion more than primitive science. It is simply a postulate from which to explain things, a principle of which one may take advantage in many practical problems. The following is an example of an animistic belief in which the practical element is clearly visible. The attitude concerned can hardly be said to be a religious one. The Indians of the plains believe that the whirlwind stands for mental confusion, and the dragon-fly, which is associated in some way with the whirlwind, is invoked if one wishes to produce confusion in the mind of an enemy.[2] When animism becomes among the Algonquin a theory of *manito* or among the Central Eskimo,[1] of *tornait*, we have an approach a little more definitely to a religious type of belief.

---

[1] Cf. Jastrow, The *The Study of Religion*, p. 181 ff.

[2] Dr. Clark Wissler.

In so far we seem to be in agreement with Brinton when he says, "There is no special form of religious thought which expresses itself as * * * the belief that inanimate objects are animated and possess souls or spirits. This opinion, which in one guise or another is common to all religions and many philosophies, is merely a secondary phenomenon of the religious sentiment, and not a trait characteristic of primitive faiths."[2]

We have been trying to note some of the characteristics of the embryonic religious consciousness. We have assumed that there must have been a time when there was no such thing.[3] In some way it came into existence and throughout the history of the human race it has formed a perfectly definite attitude. It has thus had a natural history, which it is our part to investigate. There must have been certain situations that favored its development to the degree we know it among the culture races. It does not help us very far forward in our quest to postulate a "religiosity of man as a part of his psychical being."[4] This very religiosity is a product and needs itself to be analyzed. This we have tried to do in the immediately preceding discussion. In the same line we wish now to point out the importance of the social group in the development of this religiosity.

There seems to be intrinsically no reason why the notion of more far-reaching values may not have developed with individuals as with social groups, except that the group furnishes a more stable atmosphere for such a development. The highest religions show unmistakable signs of such an influence in their evolution. It is possible that religion to a certain extent developed along individual, as well as social lines, but only in the latter did it attain its greatest richness of content, and perfected many of its most characteristic features. Hence, it seems to me, it is on this side that it is to be most clearly distinguished from the non-religious attitude.[1] It would be difficult to conceive how the notions of love, spiritual relationship, truth, moral duty, and the like could have arisen outside of a social context. The social structure at least gives body and permanence to the religious attitude. For example, if a people holds to an animistic belief, the spirits which have a definite place in the social consciousness are more important and permanent than the unattached ones, or the ones in whom individuals alone have an interest. As is well known, W. Robertson Smith[2] held that all primitive religion is essentially communal, but Professor Brinton, as stated above, takes decided issue with him on the point. Under strictly communal forms of worship Brinton classes the assemblage, the festal function, the sacrifice, and the communion with the gods.[3] In addition to these there are, he holds, certain purely individual rites, classified as follows: those relating to birth, naming, puberty, marriage, and death.[4] It may be said, however, that in the lower races these rites are as purely communal as are those of the first classification.

---

[1] *The Central Eskimo*, Boas, The 6th annual report of the Bureau of Ethnology.

[2] *Op. cit.*, p. 135.

[3] Cf. Brinton, *op. cit.*, p. 34 ff.

[4] Brinton, *op. cit.*, p. 30.

---

[1] It is interesting to compare with this theory that of Professor Tufts, above mentioned, regarding the social origin of the æsthetic categories.

[2] "It was a national not a personal providence that was taught by ancient religion. So much was this the case that in purely personal concerns the ancients were very apt to turn, not to the recognized religion of the family or of the state, but to magical superstitions. The gods watched over a man's civic life, they gave him his share in public benefits, the annual largess of the harvest and the vintage, national peace or victory over enemies, and so forth, but they are not sure helpers in every private need, and above all they would not help him in matters that were against the interests of the community as a whole. There was therefore a whole region of possible needs and desires for which religion could and would know nothing, and if supernatural help was sought in such things it had to be sought through magical ceremonies, designed to purchase or constrain the favor of demoniac powers with which the public religion had nothing to do. Not only did these magical superstitions lie outside religion, but in all well ordered states they were regarded as illicit. A man had no right to enter into private relations with supernatural powers that might help him at the expense of the community to which he belonged. In his relations to the unseen he was bound always to think and act with and for the community and not for himself alone." *The Religion of the Semites*, p. 246. With reference to this Brinton says, "This statement is contradicted by nearly every primitive religion known to me." Brinton, *op. cit.*, p. 177.

[3] Brinton, *op. cit.*, p. 190 ff.

[4] *Ibid.*, p. 192 f.

From first to last they are avenues through which the social group impresses itself upon the individual for the purpose of making him the more conscious of its superiority and authority. We do not question but that there are individualistic elements in these rites, but the social side is by all odds the most important. The birth of a child is naturally an event of considerable moment, either positively or negatively, to many primitive groups, and one is tempted to feel that where the rites are apparently private they may well have derived their religious value from earlier practices of the same sort by the group. But it does not seem vital to the rest of our theory that primitive religion should be found to be entirely communal in character. There could be no greater mistake than to suppose that there are rigid lines of separation to be traced in the development of individual and social attitudes. The extent to which the social body determines the psychic development of the individual is certainly indefinable in any accurate sense. It can only be said that there is an interaction between individual and group of the most intimate character. While society impresses itself upon its various component members, there *is interaction*, it is not all social consciousness. The point which we wish to insist upon, and it probably lies between the position of Smith and that of Brinton, is that religious values and all that goes to make up the distinguishing features of the religious consciousness have evolved most fully in the atmosphere of the social group.

In the same article quoted by Brinton[1] to illustrate the personal side of primitive religion as it comes out in the ceremonies attending birth, we find also abundant evidence that the community begins very early to impress itself upon the infant's mind. Children among the Zuñi, we are told, are initiated twice into the *Kohko*, a sacred order, the first initiation occurring in mere infancy. All boys join the order again but the second initiation is optional with the girls. To the fully initiate are revealed the sacred secrets of the tribe. What is true of infancy among the Zuñi, is true to an even more marked degree of the other religious rites mentioned by Brinton as personal. We have already spoken of the secret names of the Central Australians. Marriage and initiation with them are essentially social affairs,[1] fully as much as the festival or sacrifice which have been mentioned as characteristic of communal religion. Practically all the illustrations adduced by Brinton in his section on the personal side of primitive religion have clearly an important function in impressing upon the individual the authority of the social group, and more than that are the occasion for as definite expression of the social life as are festivals and sacrifices. In fact they are often accompanied by feasts and rites of various kinds on the part of the whole group. In connection with death Brinton himself mentions funeral feasts[2] Perhaps one of the best illustrations of the social significance of death is to be found among the Central Eskimo, as reported by Boas in an article to which we have already referred. No member of an Eskimo village may hunt for three days after the death of another member. Even in the more personal custom, which is said to be inviolable, whereby an Eskimo family casts away all of its clothing after the death of one of its number, we have really a communal rite, the breach of which would bring the offender into serious conflict with the rest of the group. In other words the enforcement of a rite of practice through tribal custom is itself evidence of its communal and not merely individual character.

---

[1] *The Religious Life of the Zuñi Child.* The Annual Report of the Bureau of Ethnology, Vol. XI., p. 132. Cf. Brinton, *op. cit.*, p. 193.

In many cases the community seems to perform death and burial ceremonies for the purpose of guarding itself against the return of the spirits of the dead.[3] That the burial customs of the Australians are communal and not individual in their religious character, is abundantly evident in the account given by Spencer and Gillen.[1]

---

[1] Spencer and Gillen, *op. cit.*, Chapters III., VII., VIII., IX.

[2] *Op. cit.*, p. 208.

[3] Thus among the Kar Nicobarese, "if a death should occur in the village proper, the natives after conveying the corpse to the 'dead house' in *Elpanam*, for fear of the spirit, barricade themselves in their houses and keep fire burning before the doors." "For some days after a death the *tamiluapanas* institute ceremonies for the purpose of expelling the ghost from the village." "It was customary for widows to have have one of their fingers cut off, and if they refused to submit to the operation, the posts and doorways of their houses were gashed and notched." For numerous other practices of the same character, as well as for further details regarding the above, see, *In the Andamans and Nicobars*, C. B. Kloss, 1903, New York and London, pp. 303-307.

As regards the general problem of the social character of primitive religion, statements similar to the following can be found in almost every account of the natural races: Their (the Zuñi, Tusayan and Rio Grande Pueblos) sociology and religion are so intimately woven together that the study of the one cannot be pursued without the other, the ritual beginning at birth and closing at death. Of the Tusayan Pueblos in particular it is said that the Spanish priests sought to prohibit the sacred dances and votive offerings to the nature deities, and similar observances, and to suppress the secret rites, religious orders and societies, but these were too closely incorporated with the system of gentes and other family kinships to admit of extinction.[2] There are four classes of mystery men among the Ojibwa.[3] First the medicine men proper who are chiefly engaged in the administering of incantations and the exorcism of demons. The other three classes are devoted to work of less public and general interest, including jugglery, antagonism of the evil charms of rivals, the making of charms, and decoction of herbs. These practice their profession singly, while the first are organized into a society containing many persons of varying degrees. Admission to membership is difficult but important. The society maintains the tribal traditions regarding cosmogony and the genesis of man, etc. "The being who originally instructed the Indians is called Minabozho and the method pursued by him is dramatically rehearsed at the initiation of a candidate into the society. * * * By the Ojibwa, this entire process is firmly believed to be of a sacred and religious character" (p. 67). The Menomini have a similar organization, in connection with the elaborate initiation, into which various ethical precepts are enunciated. Parents are urged to teach their children to be honest and never to permit them to learn to lie or steal. Various utterances show the religious and sacred character of the ceremonies. "It is good for us to follow the injunctions of Manabaish and to gather about within the *mita wikomik*. The old people before us have spoken of the benefits to be gained by gathering here, I have now spoken about what the white heads have told me" (p. 82). "Our old customs appear well, the words that are spoken sound well. This is the Great Mystery's home. The practices which our old parents told us are beautiful in my eyes" (p. 82).

---

[1] *Op. cit.*, Chap. XIV.

[2] *The Sia*, The Report of the Bureau of Ethnology, 1889–90.

[3] The Menomini, The 14th Annual Report of the Bureau of Ethnology. Hoffman.

MAGIC AND RELIGION.

The relation of magic to religion is a problem closely connected with the differentiation of the religious attitude. The priority of each has been vigorously maintained. Frazier, in his monumental work *The Golden Bough*, stands for the primacy of magic, while Lang[1] and Jevons[2] may be taken as representatives of the opposite point of view. Frazier's position is that magic, preceding religion, was given up only as its value began to be doubted. Lang expresses in this question the thought of Frazier: 'Have not men attempted to secure weather and everything else to their desire by magic, before they invented gods, and prayed to them for what magic, as they learned by experience, failed to provide?'[3] As Lang points out, the evidence adduced by Frazier in support of this view is by no means conclusive, for, as he says, 'If we find a race which has magic and no religion, we cannot be certain that it did not once possess a religion of which it has despaired.'[4]

The attempted solutions of the problem have usually amounted to the partisans' outlining some particular conception of the nature of religion or magic and then proceeding to show that there were people who did or did not have practices which accorded with their predetermined notions. We do not pretend that our own discussion is free from this fallacy, for to a certain extent it is unavoidable. The only palliation for such a course seems to be to work out one's theory and apply it in the light of a thoroughly scientific genetic and social psychology. It is from the lack of an appreciation of such a necessity that much of the discussion hitherto has been 'in the air.'

---

[1] *Myth, Ritual, and Religion.*

[2] *Introduction to the History of Religion.*

[3] Lang, *op. cit.*, p. 47.

[4] *Op. cit.*, p. 47.

The period in the history of the race when either magic or religion first appeared must have been characterized by a far simpler psychic life than that found in any modern savage. Hence we can hardly assume that there then existed the developed notions that are given by many theorists of to-day as the original differentiæ of magic and religion. In other words the primary fault with much previous discussion of this subject has been that the relatively fixed concepts of the culture races are used without critical reconstruction to describe phenomena in totally different grades of experience. Hence as regards Frazier's definition of religion as "the propitiation and conciliation of powers superior to man which are believed to direct and control the course of nature and human life," we can only say that it depends for its truth entirely upon the stage of culture and upon the form in which the necessity of a religious reaction has come to consciousness. To define religion in Frazier's terms is to isolate it from any context in which it can have meaning. It is a simple matter to prove anything one wishes with such a detached definition.

Jevons, in his *Introduction to the History of Religion*, argues for the originality and independence of religion as far as magic is concerned, and in the same way disregards the genetic aspects of the development of experience. He starts with practically the same assumption as Frazier, *i. e.*, that religion is based on some sort of an idea of supernatural powers, but attempts to draw from it opposite conclusions. To prove his point he presupposes, in other words, the differentiated experience of the culture races in the peoples of primitive times. This of course is unavoidable if one starts with such a definite concept for his criterion, for the concept must be given the setting in the type of experience in which alone it is intelligible. Thus in order to render the idea of the supernatural intelligible, Jevons tells us that for the primitive man the universe was like a vast workshop full of varied and complicated machinery, that his needs were pressing and he could not take his time to "study the dangerous mechanism long and faithfully before setting his hand to it."[1] Action must be immediate. Again he tells us that for the savage there were "innumerable possible causes" for what he saw about him and in the midst of which he was turned loose with nothing to guide his choice as to which were the correct ones.[2] Concerning all this we should say that it is only from our point of view that this position is 'perilous' or the mechanism dangerous. To him the universe does not present itself as a vast workshop of complicated machinery working at full speed. It is no more complicated to him than are the needs of which he is conscious. From our point of view these are multitudinous enough, but for him they are certainly few and simple. He is conscious of the vast and complicated universe present to our experience, only at the points where certain food and danger stimuli and the like affect him. (Is it different in kind for us?) It is as these necessities are met under varying conditions that other necessities are brought to consciousness. Thus, whatever may be the condition of the modern savage, the truly primitive man was most certainly not, as Jevons suggests, "surrounded by supernatural powers and a prey to supernatural terrors."[3] Neither need we suppose that he put forth his hand with dread. The very recognition of such powers, and the corresponding adjustments of experience, are possible only in a stage of culture that has departed far from its primitive simplicity.

Such are the difficulties in Jevons' use of the supernatural. His point of course is that, if such an idea is present in the primitive mind, it will lead at once to worship and religion, for no one would be foolish enough to try to manipulate by magical practices that which was already by definition conceived as beyond calculation and control. The force of the argument rests on the supposition that the idea of the supernatural was present in the mind of the primitive man with all the meaning and connotation that it might have for us.

This discussion of Jevons is typical of the treatments of the subject, whether pro or con. Both sides err in describing religion from the side of some content rather than from its place in a certain type of experience.

---

[1] *Introduction to the History of Religion*, p. 17.

[2] *Ibid.*, p. 33.

[3] *Ibid.*, p. 35.

All important differentiations of experience, as we have seen, occur with reference to the reconstruction of the habitual or the customary that in some way fails to meet the requirements of a new situation. It is entirely likely that in primitive times there were situations of this sort which produced attitudes functionally similar to the idea of the supernatural on higher levels of culture. The situation of tension involves an interruption of a practical habit, resulting, not in the definite postulation of supernatural powers, but in the focusing of attention for the purpose of securing a more adequate adjustment of the means as perceived to the end that for the time withstands ordinary methods of approach. The point of interest is the end which cannot be reached by the usual expedients rather than the expedients themselves. Only relatively late can these be abstracted and set up as being of a certain kind distinct from other kinds, for instance as natural or supernatural. The idea of the supernatural is the extreme development of certain situations of tension, not their immediate result.[1] To the savage, it is simply that phase of a situation that must be treated with the greatest care and hence it is certainly not true that at the very beginning, as Jevons tells us, he was conscious of a "mysterious power which was beyond both his calculation and control."

We are prepared now to see that we are not, as against Jevons, obliged to hold either that magic and religion existed from the first, side by side, involving a recognition of both a natural and a supernatural, or that all was at the first felt to be entirely natural or entirely supernatural. The point of view here advocated is that both these concepts belong to a differentiated type of experience and that the primitive notion of the world can be described neither by natural nor supernatural nor by both together.

---

[1] Even with ourselves it is a concept which cannot be used off-hand, but only as we know its functional significance. For instance, does the supernatural mean with us simply a very big agency which can be placed longside smaller agencies that being smaller are natural; or is it merely a bit of conceptual shorthand for what we have not succeeded as yet in reducing to rational terms, or, still again, it is something like Kant's noumenal world, a sphere, the connection of which with the natural, is incapable of representation in terms of thought categories? Manifestly it is not a conception to carry over bodily into primitive culture.

The problem is then as to the circumstances under which the activities connected with the life process differentiated into those that we associate with magic and religion. If the supposition which we have carried over from genetic psychology is correct, there must have been a time when the religious consciousness was not definitely separated from the rest of a very simple experience. The supposition is not that man was then irreligious but that his experience was too simple to demand a religious reaction. The same must be said of magic. If, and so far as they have elements which are similar functionally, religion and magic would originally have formed part of a primitive undifferentiated attitude, and would gradually separate from each other as experience became more complex and the requirements of action more varied. This primitive attitude involved the simplest conscious adjustments of the human species to the most immediate and pressing problems of the life process. It involved habits and customs with reference to these needs and the beginnings of efforts to mediate ends of which the first crude impulses had fallen short.

In the presence of some simple demand for readjustment the savage reviews the forces of his world, as he conceives them, that he may attain the desired end. It is possible that he may conceive of particular crises in terms of spirits or animated objects, but he does it simply to render the situation intelligible. His attention is certainly upon the goal primarily, and it is with reference to it that the means have their peculiar significance.

Some of these ends or goals would come to consciousness in connection with tribal activity, others in a more or less isolated fashion with no immediate reference to social ends. As we have stated from another point of view, on a preceding page, the religious (regardless of its content) is primarily closely connected with the social consciousness. While magic has a certain technique, it is seldom found with the definite organization that primitive religion presents. The reason for the organization of the latter is of course its identification with the organized social group. Religion in primitive society may be regarded as primarily a system for the controlling of the group with reference to the ends which are felt most acutely by the group as a group. This is the more evident when we reflect that the effort to reconstruct means for an end indicates a certain control of the individual by the end. Thus, as soon as a community sets itself to accomplish something, the members are organized with reference to it, *i. e.*, the group is controlled by the end. One of the conceivable ends that controls the individuals in a group is the maintenance of the integrity of the social body. All practices designed to do this are religious, whether they are definite forms of worship or not. Among these we should class the complicated initiation ceremonies of many peoples, tribal organization involving the regulation of the individual's life in the most minute details, his naming, his eating, his hunting, where he may go, whom he may marry, and his conduct toward the various members of the tribe.[1]

---

[1] The following details regarding the Central Eskimo (*The Central Eskimo*, Boas, Sixth Annual Report of the Bureau of Ethnology) are typical of customs which may be fairly called religious in the most primitive sense. "There are numerous regulations governing hunting, determining to whom the game belongs, and the obligations of the successful hunter towards the inhabitants of the village" (p. 582). There are very strict rules prohibiting the contact in any way of land and sea game. Thus deer meat must not be eaten the same day with seal. When skinning deer the hunter must avoid breaking a single bone. Bits of different parts of the animal must be cut off also and buried in the ground or under stones. On the west shore of Hudson Bay dogs are not allowed to gnaw deer bones during the deer hunting season, nor seal bones in their season. Potstone must always be brought from the rock where it is obtained. In one section the natives address a large rock and bid it farewell in passing. At a certain dangerous cape they always shake the head and mutter in passing. The belief in spirits does not seem to be a primary postulate, but simply one coördinate with these other beliefs. Everything has its *inua* or spirit. These are called the *tornait* and are the invisible rulers of every object. Besides the ordinary *tornait* there are more powerful superior beings which are *inua* of the stars, constellations and meteorlogical processes. Most of these *tornait* may become the genii of men, but some of them, as the spirit of the sea, cannot (p. 597).

They have elaborate traditions, or system of myths, regarding Sedna, who is a female spirit and something of a supreme being. Most of the more definitely religious rites have reference to her. Thus there are great feasts in the autumn connected with the Sedna myths. The ceremonies connected with her cannot be said to be worship, but rather simply the efforts to manipulate things in view of the fact that she is a powerful spirit. To a certain extent she is

Every social group, however low in the stage of culture, has some sort of a system of organization and control and this is religion in its most primitive form.[1] It is a matter of indifference whether this control is effected through gods or spirits or without them, the process is the same whatever the content. If we choose to take some content as essential, *e. g.*, the conciliation of superior spirits (Frazier), we have an arbitrary standard, in the light of which much that clearly possesses a religious function must be rejected as non-religious.

So much for the side of religion. As concerns magic it is held that those mediating activities which do not get definitely organized into the tribal consciousness, those that are less general, more occasional, or affect individuals only, or small groups of individuals, all these furnish the basis for magic. I do not feel that it is possible even if it were desirable to definitely separate all practices into either magic or religion. The chief interest is to isolate the types of situations in which each attained its most characteristic development. It is quite possible for the two to merge in almost an indefinite number of combinations. The group may seem to practice magic and the individual to assume the religious attitude independently of the social group. It would be the more remarkable if one did not modify the other in many ways. But among all primitive peoples there does seem to exist the distinction we have made between the sorcerer who deals privately with unseen agencies, and the practices of the group. We find repeatedly mention made of the dread of the savage for sorcery and the punishments meted out to the offenders.

simply an explanatory hypothesis. For instance the story of Sedna accounts for the origin of whales, whale bone, and of seals. Many of their myths are of this explanatory type; *e. g.*, the first deer had no horns but large tusks, while the walrus had horns instead of tusks. This proved dangerous to men and an old man reversed them.

This seems to be the situation regarding the Eskimo. There are a multitude of customs regulating every detail of their lives and along with these the world about them is interpreted as animated on the analogy of human life; as such it demands complicated adjustments on the part of man if he would carry on successfully the ordinary vocations of life. Their religion is simply the observance of the duties involved in this system of things.

[1] It might also be said that this is morality and law in their most primitive form, since religion, law, and morality are indistinguishable as such in the lower levels of culture.

On the whole, magic is the primitive man's science, and it is noteworthy that it is only within modern times that society has not viewed with suspicion scientific investigations. The modern conflict between religion and science is simply a continuation of the ancient struggle between the group and the sorcerer.

We may next note how the difference in the context in which each has evolved has contributed to the peculiar development of each. Certain means suggest themselves as available in a social situation that would not in other situations come to consciousness. This is easily conceivable when we reflect that the means that do come to conciousness are always more or less the result of association by contiguity. With primitive man and with ourselves it is not the inherent connection of things that is taken into account, but simply the elements of a situation that are commonly and prominently before the attention. Hence the particular development of a system of mediation and control will depend largely upon the actual elements in the situation in which it develops. Merely by way of illustration, undoubtedly one of the important elements in any primitive social structure is the system of ideas connected with the ancestors of the group. The very social consciousness tends to retain as a part of itself the members who have passed away as well as the living. We are not, of course, suggesting that religion originates in ancestor worship but simply that the idea of ancestors is one of the elements in social consciousness, and a very primitive one too. No better illustration of this can be found than the myths of the Central Australians concerning the Alcheringa, to which we have already referred. As we have seen, the Alcheringa, without being really worshipped are bound up with nearly all their ceremonies. We have also seen how many of the ceremonies of the Kwakiutl Indians originate in the adventures of an ancestor, as also the Mountain Chant of the Navajo. It is thus by no means theoretical that the mediating practices of a tribe are involved with the idea of their ancestors, whether these are worshipped or not. If it came to be believed that they could play an important *rôle* in the mediation of tribal needs, the activities associated with them would easily assume the form of worship, or would tend to adapt themselves to the maintaining and keeping vital of the bonds of fellowship between the past and present portions of the group. As is well known, W. Robertson Smith has shown that sacrifice among the Semites was such a practical expedient.[1] Worship, with them, was a time of joyous communion. The interests of the tribe and the means of securing them would be inseparably connected with the various expressions of the tribal life and consciousness.[2] This connection of ancestors and spirits with mediating activities is possible only with those which have developed within social groups, and the contrast here with magic is significant. For magic there are no ancestors, for there can be no definite consciousness of ancestors outside of a social group. For magic there would be only spirits, and these could scarcely be of the definite and abiding character of those of religion since they would lack the sustaining influence of a tribal consciousness. Under these conditions it was an easy matter for sympathetic magic, as we know it, to develop, that is, a form of magic involving no reference to spirits and depending upon a supposed interrelation of things that are associated by contiguity or similarity.

By general consent, in so far as magic deals with spirits at all, it concerns itself with those which have no relation of good will to man, no stated relation of any kind in fact, but are simply wild and capricious. The distinction of gods and wild spirits made in some later stages of culture is further evidence of the connection of religion with the definite organization of a social body and of the more or less individual and non-social character of magic. We have already quoted W. Robertson Smith on this general subject and we would refer to that quotation now and ask that it be taken into account here.[3] The same author says also: "A supernatural being as such is not a god, he becomes a god only when he enters into some stated relation with men, or rather with some community of men. In the belief of the heathen Arabs, for example, nature is full of living beings of superhuman kind, the *jinn* or demons. These *jinn* are not pure spirits but corporeal beings, more like beasts than men. * * * Like wild beasts they have, for the most part, no friendly or stated relations with men, but are outside the pale of man's society, and frequent savage and deserted places far from the wonted tread of men. * * * The *jinn* are gods without worshippers, and a god who loses his worshippers goes back to the class from which he came, as a being of vague and indefinite powers who, having no personal relations to men, is on the whole to be regarded as an enemy. * * * In fact the earth may be said to be parcelled out between demons and wild beasts on the one hand and gods and men on the other. To the former belong the untrodden wilderness with all its unknown perils, the wastes and jungles that lie outside the familiar tracks and pasture grounds of the tribe, and which only the boldest men venture upon without terror; to the latter belong the regions that man knows and habitually frequents, and within which he has established relations, not only with his human neighbors, but with the supernatural beings that have their haunts side by side with him."[1] We have quoted at length because the point is so clearly expressed that religion is connected with the familiar and the habitual, and this for primitive man is largely synonymous with his social group. Beyond this is the great world of the occasional and hence the mysterious. It would be only the more daring and hence the few, the individuals, who would have dealings with this outer world. The contrast here drawn by Smith is, of course, based upon the studies made by him in the beliefs and customs of the primitive Semites. In general I do not believe that the division is as marked as here represented. Whether a people make this definite separation between religion and magic probably depends upon an intricate combination of circumstances. The development of a strong tribal life, or definite tribal feelings such as evidently belonged to the Semites as seen for instance in their sacrifices which were originally communal festivals, would be an important factor in such a distinction.

---

[1] *The Religion of the Semites.* Lectures VII, VIII.

[2] *Ibid.*, p. 240 ff.

[3] Page 30 of this thesis.

The point we have wished to make in this discussion is not that religion is essentially social and magic essentially individual, but that the former develops most readily in the atmosphere of the group, and the latter in that of separate individuals. Magic is simply primitive man's science and there is nothing to hinder the tribe from availing itself of the scientific knowledge in the hands of its members. Many social groups may and have adopted magical practices. Magic simply furnishes the community with a technique for doing many simple things (I mean of course simple in its own eyes). Magic furnishes a postulate available for many emergencies, and it is conceivable that it would simply stand for an attitude of approach toward many possible difficulties without becoming in any formulated way a part of social habit. As a postulate it would lend itself to each individual in the meeting of his own difficulties. We can see that in multitudes of cases the difficulty would be only occasional and in many others it would interest only the individual concerned. It is also easy to see that in a difficulty of either of these kinds the initiative of the individual would be largely called into play, if not in devising a new method, at least in adapting the old device to the new situation. Magic would thus be readily associated with the private individual and in tribes in which the power of custom was strong this particular aspect of magic, which as we have reason to believe is the larger aspect of it, would be outlawed. In communities of the opposite type, that is those of loose organization, magic might be so thoroughly taken up by the group as to be indistinguishable from religion. Many of the North American Indian tribes illustrate this aspect of the development of magic. This is particularly true of the Plains Indians. Major Powell says, however, of the Indians in general.[1] "The medicine man is an important functionary among all the tribes of North America and medicine practices constitute an important element in the daily life of the Indian tribe. But medicine practices cannot be differentiated from religious rites and observances. The doctor is priest and the priest is doctor, the medicine man is priest-doctor."

---

[1] *Religion of the Semites*, pp. 112–114.

Apparently the chief form in which magic appears in many primitive tribes is as a means for causing disease in enemies, and the public medicine man is a functionary for counteracting the evil effects of such hostile magic, either in the tribe or the individual. Thus, "The Sia have something as appalling to them as the return of the dead, in their belief in witchcraft, those possessing this craft being able to assume the form of dogs and other beasts." "They create disease by casting into the body snakes, worms, stones, bits of fabric, etc." The theurgists of the secret societies are able, however, to cope with them.[1] So among the Central Eskimo,[2] the *angakoq*, a conjurer or medicine man, is really a tribal functionary who has many ceremonies by which to drive off spirits. His principal office is to find the reason for sickness and death or any misfortune visiting the natives. Storms and bad weather are conjured by them by taking a whip of sea-weed and waving it on the beach and crying: 'It is enough.' We have record also[3] of an apparently magical rite performed by an Eskimo community. A village united to kill an evil spirit that had been causing bad weather. We have already referred to the several classes of medicine men among the Ojibwa, one of which is organized into a secret society and deals with matters of public concern and is distinctly religious in character, while the others are more or less private in their activities, and are responsible for the type of magic which is so much dreaded by the Indians. Among the tribes of Central Australia, "every man may have recourse to what is usually spoken of as sorcery, by means of which he may work harm of some kind to an enemy, and this power is not in any way confined to the medicine men, though on the other hand they are the only men who can counteract the evil influence of an enemy."[4]

---

[1] Fifth Annual Report of the Bureau of Ethnology, p. 46.

It is an interesting question as to why the treatment of disease among savage peoples has been so fully taken up by magic and not by religion. The answer seems to be that while sickness and death are matters of interest to the group they are more or less uncertain as to times and occasions, it is something that must necessarily interest some few more than the whole group. To be sure, after a death, it may become a matter of group concern to guard against the spirit, but before death it is a problem requiring the attention and skill of some individual. Or perhaps the treating of sickness by magic originates in the fact that it is supposed to be caused by magic and hence must be counteracted by a similar force. But in the cause of sickness by magic we can detect its individual character as opposed to religion. The medicine man who cures, on the other hand, represents the tribe in its desire to keep itself intact against the wiles of malicious individuals.

---

[1] Annual Report of the Bureau of Ethnology, '89–90, p. 68.

[2] Boas, *op. cit.*, p. 592.

[3] Boas, *op. ctt.*, p. 452.

[4] Spencer and Gillen, *op. cit.*, p. 530.

The following additional points regarding the Australians seem to bear out our theory of magic. The medicine men, although in a sense public functionaries, are nevertheless not created by tribal ceremony nor are they organically related to the organization of the tribes. They are simply highly gifted men who have proved to their fellows that they have remarkable powers. The most importent classes of medicine men are those made by certain spirits, which suggests, as the actual procedure proves, that the process is entirely a subjective and individual one. There is common a host of magical practices aside from those relating to disease and in them all indulge. They stand out in strong contrast with the tribal ceremonies described earlier in this thesis. Any individual may injure another by pointing at him a charmed bone or stick, various things may be 'sung over' by either men or women and used by them to inflict fatal injuries. Wives may also be secured by magic. These practices are one and all of personal rather than social concern.[1] It will be noted also that they are quite different in character from the individualistic elements which we have already pointed out in their tribal ceremonies.

Jevons[2] quotes from Ellis (*The Tshi-speaking Peoples*) an account of the belief of the Gold Coast negroes, which is relevant here. They believe in local spirits of a dangerous character which may, however, under certain conditions be domesticated. Thus every community has its tutelary deity, and "when a family grows so large that it must divide, the family in whose keeping the tutelary deity does not continue consequently requires a new one, or when a new town company is formed, and application is made to the priest of some local deity, who goes to the hill, rock, or river, etc., where the local deity resides" and proceeds to arrange for it to become the tutelary deity of the new family or village. In the same way individuals will seek out spirits and ally themselves with them. Such an individual spirit is called a *suhman* and its most important function is to work according, to the will of its possessor, evil of all kinds against the latter's enemies. Very different is it when an individual privately resorts to one of these spirits, because the request which he has to prefer is such that he dare not make it publicly to the clan-god, who is the guardian of the community's interest and the tribal morality. There is all the difference in the world between applying to the clan-god and to a spirit who has no reason to look with favor on one's fellow clansman, but rather, presumably, takes pleasure in injuring them.[1] The same sort of practice is also noted in Tinnevelly and in the Pelew Islands.[2]

---

[1] For full details regarding the points referred to above, *vide* Spencer and Gillen, *op. cit.*, Chap. XVI.

[2] *Op. cit.*, pp. 164–166, 174–177.

The upshot of the matter regarding magic and religion is then something like this: Of the various crises or tensions arising in the primitive man's experience, some are more recurring and insistent and others are more occasional and particular. In the former the social group feels the tension, in the latter it is felt rather by the individual as such. We have held that it is because of this very difference in the way the crisis presents itself that correspondingly different mediating activities are gradually built up. The idea of neither the natural nor the supernatural is present in this early stage. It is simply a question of how to get something done or of how to secure some experience that seems more or less desirable or necessary at the time.

Nor do religion and magic separate on the question of the supernatural. The idea may belong as legitimately to one as to the other. The presence, however, of the tribal consciousness in the one case and not in the other would render it easier for such an idea to become defined and fixed in religion than in magic. Moreover the technique for the mediation of these social crises would take the form of social habits, which we have previously discussed as the essence of primitive religion and the basis for the conservatism of religion. This is also fostered by the greater importance and more far-reaching character of the crises that the tribe itself recognizes. Magic, on the other hand, does not deal with the supernatural as such, except in the eyes of observers of higher cultural levels. Being the technique of the more occasional, it develops with reference to more specific ends and is unhampered to any great extent by social habit. Hence it offers more opportunity for the development and expression of individuality. The technique of religion, entirely because of its peculiar context, easily becomes cumberous and long drawn out. Magic, for the reasons just mentioned, offers a short cut to many of the things religion attempts to accomplish in a more circuitous fashion. With its occasional and individual problems, and its comparative lack of a fixed technique and hence its greater opportunity for individual initiative, it does not furnish a favorable atmosphere for the development of supernaturalism as such. If, in its early stages, it deals with spirits, it is simply because they are a portion of the forces relevant to the practical situations that confront it. If later on it attempts to accomplish definite results by the manipulation of various things associated by contiguity or similarity, it has in no wise departed from its original method. In its hypothesis that things are related in some manner, it is laying the foundations of true science, even though its method of judging relationship is radically wrong. On the other hand, the activities which become fixed in social habit furnish the basis for the development of the subtler feelings and sentiments which in time make up the religious consciousness.[1]

---

[1] Jevons, p. 177.

[2] *Vide* Jevons, pp. 175, 176.

THE QUESTION OF THE FUNCTION OF THE RELIGIOUS ATTITUDE.

If the religious consciousness is a differentiation from some primative type of experience, two questions suggest themselves, the answers to which we should like to outline here in lieu of a more extended treatment which we hope to give them later.

---

[1] *Vide supra*, p. 29 ff.

The first question is as to the function of the religious attitude with reference to the rest of experience, and the second is as to the apparent absence of religion in many individuals of the present day. If it is a functional differentiation, its absence is apparently an anomaly.

The question of function is a two-fold one. It may deal with the effects in general upon experience of the mere presence within it of some element. It may refer, on the other hand, to some specific end for which presumably the element has been differentiated. It is in the first and more general sense of functional that the problem of mental function must generally be discussed. Merely to describe the interaction of the various mental elements is certainly an important part of the functional problem. There are some aspects of consciousness that probably can only be stated in this general way. The entire emotional attitude, for instance, is unquestionably as important as any other part of experience, and yet its connection with the furthering of action is general and more or less mediate rather than specific and direct. The reflective consciousness, on the other hand, is quite directly related to activity. We might say that some functions are directly related to overt activity and that others are internal and mediating. The function of the religious consciousness is, it seems to me, of this latter kind. That is, it influences the general tone of activity as a whole rather than affords data for the solution of immediate problems. To be sure the religionist does modify his action in specific ways on account of his belief, but this does not prove that the religious consciousness stands on the same level as the reflective. It is one of the secondary differentiations and may more properly be called a specialization of experience than a specialization of consciousness. It is an attitude that pervades to a greater or less degree the primary differentiations.

As to its function in more specific ways, we can say (without question) that the sense of the ultimate organization of activity is important for the adequate performance of certain acts. The more intricate the reaction within itself and the more complex its connections with other reactions, the more necessary does it become to take into account things beyond the present situation. The religious attitude is one of the ways in which this may occur. It is the first way in which it occurred, and if at the present time there are other channels for the expression of the same attitude, it is a fact related to the problem of the non-religious individual. It would be impossible to state completely the functional relations of any of these mediating aspects of experience, simply because it is impossible to give an adequate statement of their social setting, and it is in certain modifications of the entire social complex from specific directions that their functions appear, rather than in the determination of specific modes of activity.

It is important to distinguish between the psychologist's and the religionist's points of view in this question of function. To the religionist, the function of his attitude is the glorification of God, to assist him in the peformance of certain duties, for spiritual growth and the like.[1] From the psychological point of view, however, we can only say that religion deepens human action and human relations and furnishes the highest sanction for certain lines of conduct. Further than this the psychologist cannot go. The religionist always recognizes the actions prompted by his attitude as good. Their actual goodness is not, however, necessarily the product of the religious consciousness, nor are religious acts necessarily good. The development of the ethical mind seems to a certain extent to have gone on independently of the religious.[2] However this may be, religion certainly does offer the highest sanction for the activity to which it is most closely related. The divine approval, the dogmas of heaven, of the spiritual life, etc., are concrete ways of stating to the religionist his sense of values. Probably a majority of mankind feel that life is worth much more than shows itself on the surface at any one moment. It is a matter of indifference how the sense of this worth is stated, provided it is recognized and the conduct of the moment governed accordingly. These religious dogmas may be taken as one of the ways in which the sense of worths may be symbolically expressed. Such a conception as this in no way underrates that for which they stand. It is easy for their possessors to postulate these dogmas as ontological realities when they lose their vital connection with the activities which gave them existence.

---

[1] Professor James Leuba has an interesting article in the *Monist* of July, 1901, in which the significance of religious states to their possessors is illustrated by a number of autobiographical paragraphs from widely different types of people.

[2] I hope to treat this point adequately at another time.

The question of the function of the religious consciousness is further complicated by the possibility of its isolation from activity and its development more or less as a thing in itself. In many cases that arise under such circumstances, it is simply impossible to say that there is any direct functional utility, although one may yet be able to interpret these cases in terms of the social situations out of which they arose, *i. e.*, the combination of circumstances which made such an isolation possible may be stated as may also the way in which the combination determined the specific line of development which subsequently occurred.

It is only as the religious consciousness is conceived from the functional point of view that it is possible to discuss intelligently the question as to whether religious consciousness is necessarily always present in every developed mind or whether there are some people and individuals in whom it is absent. If we have the correct conception of religion it would seem that every human society would differentiate elements which would be analogous if not identical in function with what we have recognized as religious. That is to say, every society must have its systems of control, the more fundamental of which inevitably assume the religious form as they are taken up into the sphere of habit. When the social system becomes so highly differentiated as to require the exercise of constant attention in order to make the readjustments needful for the complexity of its life, religion ceases to be so much a social affair, or it may be said that it begins to be isolated from the social consciousness. This shift from society to the individual we wish to discuss in detail in the further working out of this subject. It is this which opens the way for the disappearance of religious consciousness in certain types of individuals. In proportion as it is detached from its social setting the greater the number of possible variations in its nature, and form of expression. It would not be strange if on this individual basis it should in some cases be found to be largely, if not altogether, lacking.

For those who assume that the religious is a sense, or instinct, having no organic relation with the other constituents of consciousness it is difficult to admit that it may be absent in certain individuals. To prove that it is always present, the most painstaking efforts have been put forth to show its existence in even those professedly the most irreligious. If at some time in his life such an one shows a glimmering of the religious attitude, as does proverbially the profane sailor in the storm, it is at once assumed that this is proof positive of the existence of a deep-lying religious instinct. There are propably few if any people who do not at some time in life have such an attitude, but its spasmodic appearance is not evidence that it is a deep-lying instinct, nor is the seemingly continuous religious consciousness of some others any more evidence of it. If the religious attitude is a differentiation with reference to certain situations, we cannot hold that it is continuous except as these situations are more or less continuously present in consciousness. If there should be found persons who never or only occasionally evaluated situations in the religious manner, it would be better, instead of putting it in terms of instinct, to say that there was present in one case a particular organization of personality that reacted in a certain way to situations which brought forth no response in others of a different organization of experience.

This raises the question as to what circumstances tend to reduce the possibility of such reactions or to do away with them altogether. We are not concerned here to prove either that there are some who are never religious or that every one has some sort of religion, but rather to inquire into the conditions that tend toward a diminution of the religious type of mind. If there are such conditions, there would be nothing *a priori* against the existence of certain forms of experience in which the religious element was totally lacking.

In so far as religion continues a social phenomenon, that is the expression of a certain tribal or social attitude in which the life of the whole is bound up, it is naturally present in all members of the community in approximately equal degree. Religious practices being almost entirely objective, it would be easy for social pressure and social suggestion to produce a common type of religion. The individual differences so prominent among the culture races cannot emerge to any great extent. This is totally changed as social pressure becomes less imperative. Individuality in all lines comes more and more into evidence. Some people are seen to be more reflective and subjective, others more direct and objective. As individuality becomes thus prominent, there is less likelihood of social suggestion exerting so great an influence and hence there is less uniformity in the conception of ultimate values. In so far as this conception has been identified with the social life of the community it is impressed upon all alike. He who shares in the life of the community is necessarily religious. The opposite would be inconceivable. "A man did not choose his religion or frame it for himself, it came to him as part of the general scheme of social obligations and ordinances laid upon him, as a matter of course, by his position in the family and in the nation. Individual men were more or less religious, as men now are more or less patriotic, that is, they discharged their religious duties with a greater or less degree of zeal according to their character and temperament but there was no such thing as an absolutely irreligious man."[1] In the ill-organized Indian tribes of the American plains the group as a whole does not engage in the performance of a ceremony but only the older or more devout minded ones, while the majority of a group, ostensibly devoted to the performance, give attention to it only casually and spend their time for the most part in various sports. The contrast between the Indians and the Semites is very suggestive. In the case of the former we have evidence of the appearance of a non-religious attitude apparently due to the imperfect development of the social body. The modern civilized community represents the same condition of affairs, but produced in a different way.

As individuality has developed in the modern community, the more suggestible conform to the general type more than those of overt and active temperaments. Still others by contrary suggestion tend to assume an opposite type. Still others never have their impulses defined in this way because of the looseness of the organization of modern society. Thus in two different ways a type of consciousness which is more or less non-religious is gradually produced.

---

[1] Robertson Smith, *op. cit.*, p. 29.

It is not meant that the activity of the non-religious is unmediated by the more ultimate values. A great many religious values are carried over into the conduct and life of those who recognize no religious consciousness. That is to say, religion has so thoroughly mediated certain forms of conduct that the performance of them in the religious manner has become recognized and automatic. The religious mind is distinct from the non-religious in that it not only embodies in its life the values of religion but does it more or less consciously. It has been asserted that the basis of religion is the feeling of dependence. In a sense this is true. At least it is probably in this connection that the religious attitude appears in the ordinarily non-religious, although the developed religious consciousness is certainly much richer than this. The feeling of dependence may be counted an instinctive attitude, present in all people in a greater or less degree, and in certain crises capable of rising to the uppermost place in the minds of most men. It is comparatively easy for social suggestion or memory to interpret this in religious terms, and this is about all that can be said for its intrinsic religious significance.

The Content of the Religious Consciousness and the Causes Governing its Selection.

The problem which now confronts us is one of the most interesting in the psychology of religion. It is the problem as to why certain mental states and certain overt practices have been selected as peculiarly fit for the expression of the religious attitude. In this thesis the development of religious expression has already been traced in some of its early stages. Such a statement should give an historical setting of considerable value for estimating the more subjective religious attitudes of the culture races. There is, however, a deeper question not thus far touched upon. The foregoing considerations account simply in a general way for the overt forms of religious expression.

Back of these overt manifestations there are of course certain states of mind, certain evaluations of these external practices. These states of mind come to be regarded as of peculiar religious value and when they are selected, or recognized, they tend to emphasize the overt reactions that have been most potent in producing them. Why these religious states have been thus selected is the deeper question that concerns us here.

From the standpoint of the devotee such a question is absurd. Sacred acts are such because they have been ordained by the deity or because they have received his sanction as the appropriate means of drawing near to him. Particular states of mind are religious for the same reasons, because they have the divine sanction, because they open the individual to divine influences, or because they actually emanate from the divine nature itself. This latter view though the most extreme is the logical outcome of the preceding ones. In short the forms of religious expression, and particularly their mental concomitants, are taken as something given and hence as requiring no further analysis, or as something incapable of further analysis because existing out of any connection with the rest of the overt or mental life.

A genuine psychology of religion cannot stop short of a complete analysis of all the aspects of the religious consciousness, or at least an analysis as complete as it is possible to make of any other mental phenomena. It is without doubt important to have information as to how religious impulses find expression, whether in sacrificial rites, feastings and merry-making, penances, ascetic practices, fastings, the keeping of holy days, or whether solely in certain states of mind recognized as peculiarly religious, certain others being condemned as non- or anti-religious in value. We must not, however, consider any of these expressions as data about which no further questions need, or can be asked. If, as has been maintained, the religious consciousness is to be interpreted as a form of reaction, it must submit to all the categories that apply to other reactions.

It is on the mental side that there has been the most notable failure to analyze religious reactions, although this is, in fact, the ultimate problem, inasmuch as the overt forms themselves, in developed religions, reduce to the mental. The need of a better analysis is well illustrated by the common theories of the relation of emotion to religion. The question is not here raised as to whether emotion is the paramount element of the religious consciousness, but rather what does it mean for religion if this class of mental phenomena does have peculiar value for it, and also whether in taking emotion as an ultimate state, capable of being considered alone and out of relation to the rest of the mental life, there has not been a tendency to take a narrow and consequently inadequate view of religion itself. The answers to these questions involve an examination both of religious expression and of the functional significance of emotion. Should such an inquiry indicate that there is no such thing as a *merely* emotional reaction, it would appear that the student of religious phenomena could never properly define religion as emotional or any thing else *per se*. The problems before us may be restated thus: What is the psychology of reaction, and why have particular types of reactions been regarded as peculiarly religious?

The first problem was discussed in the first sections of this thesis. As a corollary, it may be here added that there is, strictly speaking, no such thing as mere emotional expression. An expression is always an entire activity, in which now one element and now another may receive attention, so that it may come to be called intellectual or emotional, as the case may be, but in any case it is always a reaction of the organism as a whole toward a certain stimulus or situation. This reaction represents the evaluating attitude assumed by the organism toward the situation. When we say the organism as a whole, we have in mind its power both to conserve its past experiences and to adjust these to new problems. Every reaction involves necessarily both the values of previous adjustments and as well the adaptation of these adjustments to the specific nature of new stimuli. If the retrospective values are most prominent so that there is little new adjustment, the reaction is emotional. If the emphasis is on effecting a readjustment in which past values consciously enter, the reaction is intellectual. If the adjustment is immediate, involving little consciousness of retrospective elements, the reaction is more or less habitual. From the nature of a reaction, it us thus impossible that it be described off-hand as emotional, intellectual or automatic. These terms themselves must be interpreted. If a reaction or attitude, therefore, is described as emotional, we have by no means made an ultimate statement regarding it; the question still arises as to the nature of the organization of the reaction that causes one part of it to stand out more prominently than the others, or the further question as to whether the reacter has been led to give attention to one aspect to the neglect of the others. The first question relates to factors that vary with the situation and the immediate organization of the individual. The second deals primarily with the more ultimate organization of the individual and seeks to explain why he has come to regard certain elements in his reactions as of supreme worth and has consequently tried to emphasize *them* and to minimize the *others*. The first has been answered by the statement that all expression consists of entire reactions, which are differentiated, not through their inherent and ultimate constitution, but through the varying interests and points of view of the individual himself. The second question relates to the influences that lead the individual to have constantly a certain interest or point of view regarding his reactions entirely aside from what they are as contents or processes to the psychologist. The real problem of the psychology of religion is thus not whether it is predominently emotional or intellectual or both, for religion consists essentially in entire reactions. It is rather as to why certain elements in these reactions have been regarded as of more worth than others and consequently have tended to be abnormally developed.

Preparatory to an answer to this question let us note in a summary manner the sort of activities that have at various times been taken as expressions of the religious sentiment. The array is of course very diverse. In the list are trances, dreams, ecstacies, fastings, penances and kindred pathological and neurotic phenomena, of which H. R. Marshall makes the remarkable and characteristically absurd assumption that they were originally induced in people by priests to strengthen the authority of the latter over them.[1] In the category of religious expression there are also various emotional states such as exaltation, humility, love, charity, intolerance, bigotry, persecution of all descriptions. We find also the phenomena of suggestion from its simplest forms to such tremendous upheavals as the Crusades. There are also and have been sects, ostensibly religious, bound together by strange ties and for strange and even immoral purposes. It will be objected, no doubt that many of these things are not expressions of genuine religion. It is sufficient to answer that they have at any rate occurred under the sanction of religion, and that whether they are its true expression or not, there must at least be something about the religious attitude that, under favoring conditions, will produce just such activities and states of mind. Such a supposition seems, *a priori*, entirely legitimate from the functional point of view. It it not legitimate to attribute all of religion's undesirable concomitant phenomena to some totally disparate forces, *e. g.*, the Devil. The religious attitude is not something that exists entirely in and of itself. If it exists at all it is as an organic part of the entire life-process. It is a specialization of the elements involved in this process with reference to certain conditions and certain stimuli. The distinction between the religious and other attitudes is purely a functional one and does not refer to ontological differences. Hence the manifestations of this form of consciousness must be subject to great diversity, for whatever involves the reaction of the psycho-physical organism lays itself open to all the possibilities for reaction which that organism contains. The sort of reaction which occurs at any particular time depends on the way in which the stimulus is presented and the sort of stimulus it is.

---

[1] Quoted by A. T. Hadley in the February *Atlantic*, 1903.

It is important for the adherent of any religion to recognize these simple psychological facts that he may realize his right and duty to control his reactions. Hitherto that which has come to be regarded as religious activity has been largely the result of chance selection. The forms occurring oftenest have been gradually crystallized into habit, it being assumed that they were necessarily the unique and not-to-be-questioned expression of an attitude that could be defined solely in terms of itself. From our point of view it is the duty of the religionist to get under his control the most desirable forms of religious expression. This can be done only through a study of the psychology of expression and the functional significance of its varieties.

We may now take up more intelligently the diverse manifestations of religion and inquire into their relation to the religious attitude, that is, why they have been selected and what their relation is to the more or less pathological and neurotic phenomena that seem to be associated with some types of religion. It must be kept in mind that the religious attitude is to be distinguished from the larger whole of consciousness only on functional grounds, and that it therefore bears a definite relationship to the universe of consciousness within which it exists or is distinguished. One of the most important aspects of this relationship is suggested by the following sentences from LeBon[1] "A person is not religious solely when he worships a divinity, but when he puts all the resources of his mind, the complete submission of his will and the whole-souled ardour of fanaticism at the service of a cause or an individual who becomes the goal and guide of his thoughts and actions." Again, "It is a platitude to say that religion is necessary for the masses, because all their ideas take necessarily the religious form, a form which obviates the necessity of discussion. The objects of religious belief change but it can hardly be said that the religious sentiment has itself changed." As here suggested the religious consciousness is not only related to the remainder of consciousness, it is actually synonymous with certain of its aspects. In other words there is what LeBon calls the religious form, a form not peculiar to religion but belonging to many other conscious-phenomena. An idea is in the 'religious form' when it is established in those regions of the mind in which it does not come into direct, active competition with other ideas. To this portion of consciousness the terms habit, margin, fringe, subconscious mind, etc., have variously been applied. Perhaps such a term as habit or fringe is more desirable than subconscious mind for it is more exact and carries with it no mysterious connotation. We refer simply to those mental operations and the overt activity connected therewith which are in a greater or less degree removed from the center of consciousness, or from that region in which the adjusting activities are the most fully focalized. In fact the conception of the fringe, as presented by Professor James,[1] we wish to carry over *in toto*, in so far as it may be taken as a description of mental structure. Of its functional significance we shall have something to say later.

---

[1] *The Crowd*, p. 64.

Through the notion of the fringe we account for the more or less unconscious influence upon present activity and thought of a vast mass of one's past experience as well as the whole circle of instinctive impulses and tendencies. These elements are all, under ordinary circumstances, fused in the consciously directed activity, giving it tone and vitality. There are various circumstances, however, under which the fringe asserts itself. These are ordinarily times of diffused consciousness such as the dream state, either in sleeping or waking periods. Whatever forces tend to cause the focal portions of consciousness to dissipate, in so far emphasize the marginal control. This occurs under all forms of strong excitement, either self induced or suggested, when, as is often said, action is on the impulse. The fringe itself is to a certain extent organized, but usually only in separate threads differing thus from the center in which these threads are coördinated or susceptible of coördination. All manifestations of impulse, instinct, emotion, habit, etc., may be regarded as phenomena in which marginal influences are relatively prominent. There is, however, no line of absolute demarcation between the margin and the focus. The distinction is rather in varying degrees of organization.

The marginal portions of consciousness are especially active in the crowd, or mob. This is primarily due to the fact of suggestion. Action upon suggestion is opposed to that originating in the focus of consciousness in that it involves little or no direction from the rest of the self. Such action is *merely* spontaneous. An impulse once aroused tends to work itself out with little hindrance from other impulses in the margin because they are not organized into inhibiting systems. Thus it is that suggestions of all sorts from the most innocent to the most vicious are easily taken up and acted upon. Whatever impulses there may be in any direction, which are set free by suggestion instead of by the more organized portions of consciousness, become, in so far, phenomena of the fringe. This, as we take it, is the psychology of mob mind, and it is this form of mental activity that LeBon calls the religious. He is correct, however, only because the mental phenomena of mobs and of the religionist have for their common ground the fringe rather than the focus of consciousness. Our immediate problem is not as to whether it is desirable that religion should have such a basis, but why those phases of consciousness removed from the central stress have come to be regarded with the most favor. The question of values is, however, an important one, especially in view of the attitude assumed by Professor James in *The Varieties of Religious Experience*. Here he gives abundant evidence of the dependence of religion upon the subconscious elements. His decided approval and attempted justification of it renders the necessity of a functional examination more than otherwise apparent. James really attempts no such analysis, estimating the value of the phenomena of the fringe on purely pragmatic grounds. We have seen that all the elements of consciousness are organized into definite reactions, but that their mode of combination may vary indefinitely. There can be no intelligent discussion of the effects of any portion of a reaction upon conduct without a preliminary genetic and functional examination of those portions. Failing to do this we have no general grounds on which to determine the relative validity of the fringe and the center and hence it is not only easy for James to say anything about it that he pleases, but, further, there is nothing to hinder his extreme assumption that the fringe may reveal worths that the center has no access to, that it may in fact be a means of communication with a beyond of some sort.

---

[1] I make the term include even more than does James, believing that it can logically be used as a generic term for subconscious phenomena of all kinds. The justification I shall have to defer.

The following passages from *The Varieties of Religious Experience* will render James' position clearer. We can afford to pause over it as it is an attempt to justify on psychological grounds the common religious view. On page 16 of this work it is held that the validity of any experience must rest ultimately on its results. This is the test of the experiences of the mystic. "Some persons follow more the voice of the moment in these cases, some prefer to be guided by average results. Hence the sad discordance of many of the spiritual judgments of human beings." The term spiritual here, as in common parliance, is indefinite because it is unanalyzed. Spiritual judgments must refer to those determined largely by fringe elements. The guidance by the average is another way of saying that the center asserts itself and that judgment is through reason instead of through the associations by contiguity of the more mechanical portions of the mind. James defends religion from those who point to its neurotic elements by maintaining that no scientific theory is impugned by the fact of its author's having a neurotic constitution.[1] This, as he suggests, is because the validity of such a theory rests not on subjective but on objective grounds. We hold that with religion the case is different. We cannot thus completely abstract a religious experience from its possessor and calculate or note its effects. Notwithstanding the claims of the pragmatist, there are no effects *per se*. Even if the ultimate test is the practical consequences, it would certainly be likely that the judgment which was based on a careful examination of the concrete conditions would more probably have desirable practical effects than one which ignored them.

It is further held that the 'spiritual judgment' is based primarily on our own immediate feeling and secondarily recognized as true. The proof of the reality of an unseen world is based on certain phenomena of the fringe. On p. 58 he refers to a 'feeling of reality' other than that given by the special senses, such as the sense of presence, various mystical experiences, the sense of God's presence, etc. He calls attention to the fact that unreasoned experience is more convincing than rationalistic efforts to establish belief. As a statement of fact this is probably right. James has simply affirmed the large place held by fringe elements in the religious consciousness. That a religious judgment has its origin in these outlying regions and is accompanied by good effects does not therefore prove that it is not necessary to raise inquiries as to the nature of its origin. We cannot ignore the fact that it did come from the fringe and we have a right to ask whether the desirable results have been obtained with the most economical expenditure of energy or not. If a practical truth has been enunciated through these agencies, it does not follow that it has been obtained in a safe way and by one that we can afford to depend upon. The mind is a single organism and the various parts of it should not work at variance. It is not conceivable that the mind, an organization of forces for use in practical affairs, should, in unbalanced condition, be used by nature as an avenue for important revelations as to truth and duty. We may safely say that there is nothing done external to the organized mind that could not be better done if the latter were in its normal condition.

---

[1] P. 17.

Both James and Starbuck account for conversion through the influence of subconscious or fringe elements. James, on p. 208, quotes the following experience from Starbuck. "I finally ceased to resist and gave myself up, though it was a hard struggle. Gradually the feeling came over me that I had done my part and God was willing to do his." Starbuck's comments are referred to by James (p. 209) with approval. "To exercise the personal will is to live in the region where the imperfect self is most emphasized. Where, on the contrary, subconscious forces take the lead, it is more probably the better self *in posse* which directs the operation." Here again we have the assumption of the peculiar and isolated value of the fringe.

On page 211 we find a tendency to identify or relate the supernatural and the subliminal. The 'outside forces' postulated by theology may be, according to James, the subconscious ones of psychology. (He does not, however, hold that all supernatural influences can be covered by the action of the fringe. "Candor obliges me to confess that there are occasional bursts into consciousness of results of which it is not easy to demonstrate any prolonged subconscious incubation.") Hence the importance of the fringe in conversion logically follows. If a subject have no liability to subconscious activity or if his conscious fields have a hard rind of a margin that resists incursions from beyond it, his conversion must be gradual. His possession of a leaky or pervious margin, is thus the *conditio sine qua non* of the subject's becoming converted in the instantaneous fashion.[1] Merely as a matter of psychology we should entirely agree with this. It is an additional attestation of the large part played by fringe phenomena in the make-up of the religious consciousness. This much may be admitted without going to the extent of suggesting that the subconscious is an avenue through which extra-human influences may enter the soul, as James in another place expressly suggests may be the case. 'The hubbub of the waking life might close a door which in the dreamy subliminal might stand ajar or open.'[1] Again, 'It must always remain an open question whether mystical states may not possibly be much superior points of view, windows from which the mind looks out upon a more extensive and inclusive world.'[2] The only answer that can be given to this point is the one that comes through an examination of the functional relation of reason and emotion, a problem to which we must shortly turn.

Paralleling his valuation of the fringe, James[3] discredits the intellect in religion, maintaining the futility of trying to construct religious objects out of the recources of reason, or by the logical reason drawing rigorous inferences from non-subjective facts. Reason and philosophy do not found our belief but simply furnish grounds for what we have already believed. Feeling is the deeper source of religion.[4] In actual practice logical consistency is a minor matter. The main thing about an idea or notion is whether it has been a part of some one's experience and has served some purpose in right action. It makes no difference whether the common man is consistent in his belief or not. "Common sense is less sweeping in its demands than philosophy or mysticism have been wont to be, and can suffer the notion of this world being partly saved and partly lost."[5] Here as above we do not dispute the facts as James gives them. We hold rather that the important question is as to the exact location within experience as a whole of this disregard for consistency.

---

[1] P. 242.

[2] P. 428.

[3] P. 433.

[4] P. 431.

[5] P. 526.

Reference has already been made to the fact that every reaction is in a sense a reaction of the entire psycho-physical organism. Normally this organism is a reacting unit within which various elements may be isolated but which subserve definite ends in the complex coördination. Truth is not apprehended by any one of these elements to the exclusion of the others. Each one in a particular way contributes to the apprehension. We need not then inquire which part is most effective in directing action in the practical world, which furnishes the key to scientific truth, and which is most valuable for discerning the things of the spirit, but rather how do they all work together to produce now this result, now that.

The particular phase of this question that need here concern us is the one as to the relation of the fringe, or marginal self to the focus of consciousness, the origin and functional difference of each. From the evolutionary point of view it seems most satisfactory to regard the former as the undifferentiated matrix out of which the more definite conscious states have arisen. Its content at the first may be thought of as mere undefined feeling. In the more developed consciousness it embraces all that is not present in the center of attention. Habit in the broader sense of the term covers much that is included in the margin of consciousness. It may be said that in the main here also are to be found the values of the adjustments, individual and instinctive, hitherto worked out, in so far as they are elements of consciousness at all. The presence of the margin constantly affects the action at the center, the center in fact being simply the point in consciousness where the values of past experience, that is those stored in the fringe, are brought into most direct contact with the problems brought to consciousness by the environment. It is the point at which the fringe is utilized and controlled; where there is a selection of elements for carrying on the processes of the organism. It is the point of onward movement, of adjustment, of individuality. It is in fine a specialization out of an undifferentiated matrix of habit, instinct, and reflex action with reference to the more adequate control of action. The passage from the fringe to the center is, then, a passage from more or less incoherent and uncontrolled elements to the organized and controlled side of consciousness.[1]

As already stated the fringe is the side of consciousness that is particularly open to suggestion. It is sometimes referred to as the low-grade portion of the mind. It is not in itself low-grade, but the mind that is habitually under the domination of the fringe, one in which there is little organized individuality, little selective power, would certainly be called a low-grade mind. To maintain that new truth can be discovered through these mental outskirts is certainly little less than a contradiction in terms for whatever it can bring to light could be nothing other than a refined sublimation of the past experience of the individual and it might be a gleaning from his grossest instincts. If the organism makes positive advance through ignoring the center and depending on the margin, we can only answer that it has been at a needless expenditure of energy. The opinions and spiritual judgments of the fringe are not the more certain because they are accompanied by none of the feelings of effort with which the decisions of the centers are apparently burdened. Nevertheless the ease with which they seem to come is apt to make them feel ultimate and incontrovertible. There would appear then to be no sufficient ground for the assumption that the fringe in itself possesses any peculiar virtue for the discovery of spiritual truth. Consciousness as a whole is the instrument for the apprehension of truth, making its inroads into all undiscovered realms alike, by the same psycho-physical coördinations. To set up some elements of these coördinations as of more value than the others is to substitute for the normal movement of the mind a decidedly abnormal one.

There is a tendency in modern functional psychology (see for instance "Art Industry and Science," Dr. Fite, PSYCHOLOGICAL REVIEW, May, 1901), to regard the emotional consciousness as a stage preliminary to the rational attitude. Thus, as is well known, when we see clearly through a problem or situation it ceases to have the emotional tone it possessed while it was more or less problematic or when its difficulties were first resolved. This does not mean that emotion is of less value or that it is subsidiary and of low grade as compared to the rational processes. It means, simply, that it is one element in our reaction to the world and that its function may be regarded as that of making the reaction more adequate. As the latter becomes more organic and definite, its character changes, a specific act results. But while there is gain in definiteness there is loss in comprehensiveness. Emotion thus represents a relatively unorganized consciousness or it belongs to the fringe, giving tone and color to the processes of the center. Thus it appears that it is impossible to say anything as to the value of emotion in general. It can be discussed only with reference to its place in particular organizations of consciousness. It cannot be said, then, that it is either good or bad for religion, should it prove to be true that religion tends to be emotional. It is without doubt good for every attitude of mind to be emotional, if the emotions are of a certain kind; in fact an unemotional attitude it is not conceivable. As we have just seen, emotion has a normal and important function in the development of a reaction. How far it can vary from this function and still produce no undesiriable results, it is impossible to say. In the complexities of the highly developed experience there are an indefinite number of ways in which the emotions may contribute to the organization of a reaction. There is no question but that it may be advantageous for the center of gravity to shift at times from the centralized to the relatively diffused portions of consciousness. The more active processes need rest and enrichment from the matrix in which they exist. We have here the psychology and the justification for the mental attitude of 'surrender, humiliation, or abasement' that forms such a great part of the religious mind.[1] The letting of the center of emphasis pass from the focus over to the margin is naturally accompanied by a peculiar feeling of ease, the peace of resignation so well known to the religionist. It is a feeling clearly due to the cessation of effort to effect adjustments and the reliance for a time upon habit and the automatic and instinctive forces of the organism.

---

[1] There is however a *kind* of organization in the fringe and on account of this the fringe has a higher functiontal value than is attributed to it in this thesis. I hope to redeem myself on this point on another occasion.

---

[1] Cf. *The State of Death: An Instance of Internal Adaptation.* Jas. Leuba. American Journal of Psychology, Vol. XIV., pp. 133–145.

The action of the fringe is thus indispensable to all conscious processes, but to say this is very different from setting up the impulses originating in it as intrinsically better than those developed in the center.

One of the important contributions of *The Varieties of Religious Experience* to the science of religion is the abundant proof there adduced that the most prominent features of the religious consciousness are closely connected with the more or less automatic and subconscious aspects of the psycho-physical organism. To the impartial observer there can be no room for doubt but that in so far James' position is the correct one. In all types of religion from the grossest to the most refined and spiritual, we find abundant evidence that the well-recognized religious states are intimately allied to the familiar phenomena of the so-called subliminal mind, if they are not identical with it. In the cruder forms of religion dreams and ecstatic states are valued highly. At various times and in various stages of culture the so-called lower passions of sex and love of cruelty have been given full license under the sanction of religion. (It is to be noted that their baseness consists in the very fact that they are allowed to function in this unorganized fashion.) The consciousness of the mystic with its divine revelations, its visions exaltations, penances, etc., is undoubtedly largely of fringe origin. The waves of persecution, of every conceivable fanaticism, such as the Crusades, the sects, such as the crucifixion orders, prominent in Europe in the last century,[1] the camp-meeting and religious revival phenomena, in which suggestion plays so large a part, the ease with which the basest passions are stirred up when religious feeling runs high, all this is evidence that the religious consciousness is at least closely connected with LeBon's mob-mind. The great variability of religious sects at certain times is further evidence of the absence of the regulative principle of the intellect. Account must also be taken of the fact that many cases of insanity and semi-insanity, are often due to religious excitement or to processes set in motion by religious influences.

We are well aware that the objection will be raised that the instances cited above are not truly aspects of the religious consciousness. It will be contended that they are only exceptional cases and especially that they are possible only in exceptionally organized and neurotic individuals. To this it may be answered that it is precisely in such a way that we can discern the bearings of the religious attitude in general. In the better organized individual we should not of course expect to find these extreme phenomena, but they serve to show the natural tendencies in even the healthy mind. Professor James has met with just this criticism on the rich fund of material which he has brought together in his Gifford Lectures. The really just criticism to offer on James' work is not that he bases a psychology of religion on neurotic cases but that he fails to make a functional criticism of these very neurotic and fringe elements. If fringe elements form an important part of religion, the problem is as to why it is so. It is not answered by the contention that they are merely perverted forms of expression of religion. In the most refined types we find feeling and emotion prominent, and in many cases, moreover, we find those attitudes of mind encouraged which tend to bring out the fringe elements. Thus on the whole we may say that there must be something in the nature of the attitude itself that makes the emphasis fall where it does.

---

[1] Stoll, *Suggestion und Hypnotismus in der Völkerpsychologie.*

The fundamental assumption underlying the selection of the elements conceived as having religious value is that there is a possibility of the present physical and mental series being interpolated by extra-physical and supra-mental elements; in other words, that the relation of the divine to the human is equivalent to the relationship that exists between the members of a series — that the supernatural is simply one element in a series the other elements of which are natural and finite. This primary assumption strikes at the very roots of the authority of the focus of consciousness. The latter becomes no longer the only, or even the most important means, for the ascertainment of truth. The selection of the elements of the religious consciousness has thus been effected by a process of elimination. Deliberation has been decried because 'direct' or miraculous illumination has been assumed to be possible. It is a short step from this to the view that reason is more or less impious, at best only an uncertain guide, or to be relied upon in a very limited sphere. We have seen that such a procedure as this does not really furnish an additional means for the apprehension of truth, but simply rejects the *organized* way of getting at it for a haphazard method. By the rejection of reason, religion leaves itself at the mercy of the unspecialized and the low-grade. It *succeeds* in this casting off of reason in favor of the supernatural influences because it throws the emphasis on those aspects of consciousness about which nothing in particular can be said. There is no direct means of estimating or criticising the values of this sphere. Hence it is easy to make any assertions regarding the nature and extent of these values without fear of contradiction. It is only as we recognize the organic interrelation of all the parts of consciousness that we are able to hold up the marginal portions for criticism.

It is inevitable that the more automatic, instinctive, and marginal aspects of the mind should receive favor as a result of the depreciation of the assertive side; not that they are consciously chosen as such, but that it is psychologically necessary that marginal control should follow the rejection of normal regulative forces. As the religionist conceives it, the alternative is between control by reason and control by divine spirits; as a matter of psychological fact the alternative is between organized intelligence and the unorganized, the marginal, the automatic. The sort of control that has resulted has of course been interpreted by the religionist as supernatural, simply because he was seeking it. Thus gradually a body of conscious states is recognized as of religious value. So also the stimuli affecting the individual through the marginal channels or the ones especially effective in producing marginal responses easily attain a religious significance. Though there is much in the margin of consciousness that is regulative, it is not sufficient to insure a definite predominance of the better elements over the more undifferentiated portions of the matrix. Thus the rejection of the control of reason subjects the religionist to the possibility at least of the domination of the lowest elements of his nature, low simply because they can thus function out of connection with the more complex portions of the personality. If our analysis has been correct we are in a position to understand why suggestion, imitation, and various mental and motor automatisms have played so large a part in the building up of the religious consciousness. In fact, as we have seen, the whole catalogue of what has been called abnormal religious phenomena is the legitimate result of the application of the standpoint actually assumed by the normal religionist.

This point of view does not deny to religion pure and noble emotions, nor does it wish to rob the religious consciousness of its warmth or fervor, but it does assert that the religious state of mind as a reaction, involves a psycho-physical coördination within which the only regulative factors are the same as those of all other psycho-physical coördinations. It objects to the supposition that emotion can be considered as a state in itself apart from any functional relation to the other elements of experience. The value of any religious emotion must be determined by its relation to experience as a whole. At its best it stands only for the organization of the values out of the experience of the individual, rather than for any superior illumination with reference to ultimate truth.

The conclusion thus far then is this: In so far as religion postulates extra-mental forms of illumination or of control, that is, that the relation of supernatural to the natural is the same as that between the members of a series, the states of consciousness which it selects tend to be those of the fringe. We say this is the tendency, for the healthy-minded religious person lives better than his theory gives warrant for. His religious experience constantly submits to the control of his organized personality, his reason. In every religious community there are matter-of-fact people of sincere convictions and upright practices, who are familiarly denominated as practical, cold or rationalistic by their more fervent brethren. They represent a well-balanced type on whom the religious organization rests for the practical conduct of its affairs. It is a class which has its emotions, its inspirations, but they always appear as the expression of an organized and forceful personality.

The purpose of our discussion is not to make the warm-hearted cold or to advocate any special type of religious consciousness, but to make clear the nature of all reactions and the form of their organization. It is impossible to describe *a priori* the normal religious reaction, but some of its characteristics may be ventured. For one thing, it is probably essentially conservative in that the things that enter into it must previously have been taken into the sphere of the habitual and the automatic. It is always the time-honored, the customary, the traditional, that is given the sanction of religion. The innovations, the breaks with custom, the scientific attitudes of mind are proverbially regarded as either sacrilegious or non-religious. It is questionable whether even the new and rational must not in some way present aspects that appeal to the conservative side of the mind, if it is ever felt to have religious value. But even if this should prove to be the case it does not follow, necessarily, that these retrospective elements should be isolated from their setting, from their organization with the central and adjustive portions of consciousness to enter into the religious reaction. It is certainly reasonable to suppose that they would serve their highest function when they were organized with the focus. The religious consciousness might still continue to be retrospective, that is, its emphasis might continue to be as it now is, but there would be added to it the knowledge that the individual has the right and the duty to select and control his religious reactions, that his relation to the supernatural is not that of one external force to another, and hence, that he can do nothing impious in availing himself of his entire mental equipment. In fine, we might say this of the normal religious reaction that it is one in which the normal mechanism of control organizes the values that are recognized by the individual as ultimate, so that he becomes most vividly conscious of them as his own and as most intimately affecting him. Such a consciousness would not be coldly rational. It might possess all the warmth of emotion, but organized into a reaction in which reason also was recognized in its true and just sphere.

The Psychological Review,

MONOGRAPH SERIES.

The following *Monographs* have already appeared:

Vol. I.

1. * **On Sensations from Pressure and Impact:** Harold Griffing. Pp. 88.
2. **Association:** Mary Whiton Calkins. Pp. vii+56.
3. * **Mental Development of a Child:** Kathleen Moore. Pp. iv+150.
4. **A Study of Kant's Psychology:** Edward Franklin Buchner. Pp. viii+208.

Vol. II.

5. **Problems in the Psychology of Reading:** J. O. Quantz. Pp. iv+51.
6. **The Fluctuation of Attention:** John Perham Hylan. Pp. ii+78.
7. ***Mental Imagery:** Wilfrid Lay. Pp. ii+59.
8. **Animal Intelligence:** Edward L. Thorndike. Pp. ii+109.
9. **The Emotion of Joy:** George Van Ness Dearborn. Pp. ii+70.
10. **Conduct and the Weather:** Edwin G. Dexter. Pp. viii+105.

Vol. III.

11. **On Inhibition:** B. B. Breese. Pp. iv+65.
12. **On After-images:** Shepherd Ivory Franz. Pp. iv+61.
13. * **The Accuracy of Voluntary Movement:** R. S. Woodworth. Pp. vi+114.
14. **A Study of Lapses:** H. Heath Bawden. Pp. iv+122.
15. **The Mental Life of the Monkeys:** E. L. Thorndike. Pp. iv+57.
16. **The Correlation of Mental and Physical Tests:** C. Wissler. Pp. iv+62.

Vol. IV.

17. **Harvard Psychological Studies, Vol. I.;** containing sixteen experimental investigations from the Harvard Psychological Laboratory: Edited by Hugo Münsterberg. Pp. viii + 654. $4.00.

Vol. V.

18. **Sociality and Sympathy:** J. W. L. Jones. Pp. iv+91. 75 cents.
19. **The Practice Curve:** J. H. Bair. Pp. 70. 75 cents.
20. **The Psychology of Expectation:** Clara M. Hitchcock. Pp. iv + 78. 75 cents.
21. **Motor, Visual and Applied Rhythms:** J. B. Miner. Pp. iv + 106. $1.00.
22. **The Perception of Number:** J. F. Messenger. Pp. iv + 44. 50 cents.
23. **A Study of Memory for Connected Trains of Thought:** E. N. Henderson. Pp. iv + 94. 75 cents.

Vol. VI. (To contain about 500 pages.)

24. **A Study in Reaction Time and Movement:** T. V. Moore. Pp. iv+86. 75 cents
25. **The Individual and his Relation to Society:** J. H. Tufts. Pp. iv+58. 50 cents.
26. **Time and Reality:** J. E. Boodin. Pp. v+119. $1.00.
27. **The Differentiation of Religious Consciousness:** Irving King. Pp. ii+72. 75 cents.

* Monographs so marked are not sold separately. Vols. I–III are $7.50 each.

Vol. VI
No. 5

Monograph Supplements

March, 1905
Whole No. 28

THE

Psychological Review

EDITED BY

J. MARK BALDWIN
Johns Hopkins University

HOWARD C. WARREN
Princeton University

AND

CHARLES H. JUDD
Yale University
(*Editor of the Monograph Series*)

University of Iowa
Studies in Psychology

No. IV

EDITED BY

CARL EMIL SEASHORE
Professor of Psychology in the State University of Iowa, Iowa City, Iowa

THE MACMILLAN COMPANY,
41 NORTH QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK.
Agent: G. E. STECHERT, London (2 Star Yard, Carey St. W. C.);
Leipzig (Hospital St., 10); Paris (76 rue de Rennes).

Vol. VI
No. 5

Monograph Supplements

March, 1905
Whole No. 28

THE

Psychological Review

EDITED BY

J. MARK BALDWIN
JOHNS HOPKINS UNIVERSITY

HOWARD C. WARREN
PRINCETON UNIVERSITY

AND

CHARLES H. JUDD
YALE UNIVERSITY
(Editor of the Monograph Series)

University of Iowa
Studies in Psychology

No. IV

EDITED BY

CARL EMIL SEASHORE
Professor of Psychology in the State University of Iowa, Iowa City, Iowa

---

THE MACMILLAN COMPANY,
41 NORTH QUEEN ST., LANCASTER, PA.
66 FIFTH AVENUE, NEW YORK.
AGENT: G. E. STECHERT, LONDON (2 Star Yard, Carey St. W. C.);
LEIPZIG (Hospital St., 10; PARIS (76 rue de Rennes).

No. IV. 1905

CONTENTS

Perimetry of the Localization of Sound 1
DANIEL STARCH

Periodicity and Progressive Change in Continuous Mental Work 46
C. E. SEASHORE AND GRACE HELEN KENT

A Case of Vision Acquired in Adult Life . . . 102
JAMES BURT MINER

PERIMETRY OF THE LOCALIZATION OF SOUND.

BY DANIEL STARCH, A.M.

The purpose of this research is, first, to determine the data and elementary processes of the localization of sound; and second, to obtain some accurate measurements of the ability to discriminate between directions of sounds.

The localization of sound, as a field for investigation, was opened by Weber[1] in 1848, and since then various problems have been approached with more or less success. The early experimental contributions were crude and introductory, and only the more recent researches were made along specific lines, such as peculiarities of median plane localization, the outer ear in its relation to the localization of sound, the localization of fused sounds, etc. The keenness of perception of direction has been tested in part but the results thus far gained disagree in their essential respects, demanding more detailed consideration.

In the present investigation, typical directions in two representative series of planes (horizontal and vertical) were chosen. Accordingly, two main series of experiments were undertaken. The aim of the first was to find the least perceptible difference between directions in horizontal planes, and the aim of the second was to find the least perceptible difference between directions in vertical planes.

The apparatus consisted of the Seashore sound perimeter which was described by the designer in THE PSYCHOLOGICAL REVIEW, X., pp. 64–68. Professor Seashore has kindly consented to reprint the description in this connection.

THE SOUND PERIMETER.

Recent studies in auditory space perception have shown that the power to localize sounds rests, to a great extent, upon secondary factors. What unaided introspection would lead us to consider direct acoustic sensory data, exact experiment often reveals to be only associations or the result of subconscious influences of some sort. In future experiments more attention must be paid to the elimination or control of these associations and suggestions. Within the last few years, much good work has been done in the study of the localization of sound, but all with crude and often inadequate apparatus. None of the sound cages, or substitutes for the same, which have been used, could have been operated without giving suggestions that would tend to invalidate the results. Only those who, like the writer, have been engaged in these experiments, can fully appreciate this criticism. Results have been obtained at the expense of wasted time and patience in the effort to conduct the experiments on such plans that the shortcomings of the apparatus might be overcone.

---

[1] *Berichte der kgl. sächs. Ges. der. Wiss.*, II., Bd. (1848), S. 237.

In order to be adequate for most purposes, the apparatus for the producing and registering of the sound which is to be located should permit, among others, the following variations in the stimulus without giving any suggestion or counter-suggestion to the observer: (1) the direction of the stimuli from the middle of the aural axis, (2) the intensity of each of the stimuli, (3) the distance of one stimulus, (4) the number of stimuli to be given simultaneously or in succession, and (5) the order and frequency of stimuli from a given position.

The sound perimeter shown in Fig. 1, has been designed to meet these requirements. It consists of a system of telephone receivers so mounted and connected as to make the above-named variations possible. The main frame is made of iron tubing and braced in such a way as to afford the maximum rigidity with a minimum of material which might reflect sound. The receivers through which the stimuli are produced, are mounted on movable arms, which may be denoted *A*, *B*, *C*, and *D*, respectively. Arms *A* and *B*, each representing an arc of 135° of a circle whose radius is one meter, are so mounted on a common center at the top that they may swing in the same course, describing a part of the surface of a sphere one meter in radius. Each of these arms carries a pointer, which moves under the circular scale placed above the bearings. This scale is graduated in five degree-units and marked with large figures, which may be read from the experimenter's position behind the tablet on the main support of the frame. The two arms are mounted on a common axis, but they turn on independent bearings, so that there is no friction between them. The arms are turned by means of cords which run from the experimenter's tablet up to pulleys at the top of the frame and thence to wheels mounted on the upward projections of the arms. There are two of these cords for each arm; pulling one cord turns the arm to the left, and pulling the other turns it in the opposite direction.

The third arm, *C*, turns in the surface of the same sphere as the other two arms, but is mounted on the side and counterbalanced, so that it may be turned readily by means of the crank which is seen directly above the tablet. The pointer on the crank runs over a circular scale which is graduated in five-degree units, in the same manner as the scale for arms *A* and *B*. The axle which carries this arm may be drawn back through the frame so that the arm may pass the other two arms without striking at the top, and so as to be out of the way when not in use.

Arm *C* may be removed by pulling the axle out after detaching the crank. and arm *D*, a straight rod, will fit in its place of support. In Fig. 1, arm *D* is seen only in part, being stored away on the side of the main upright of the frame, This arm carries the receiver on one end, and is graduated in centimeters for guidance in the adjustment of the distance of the receiver from the center of the

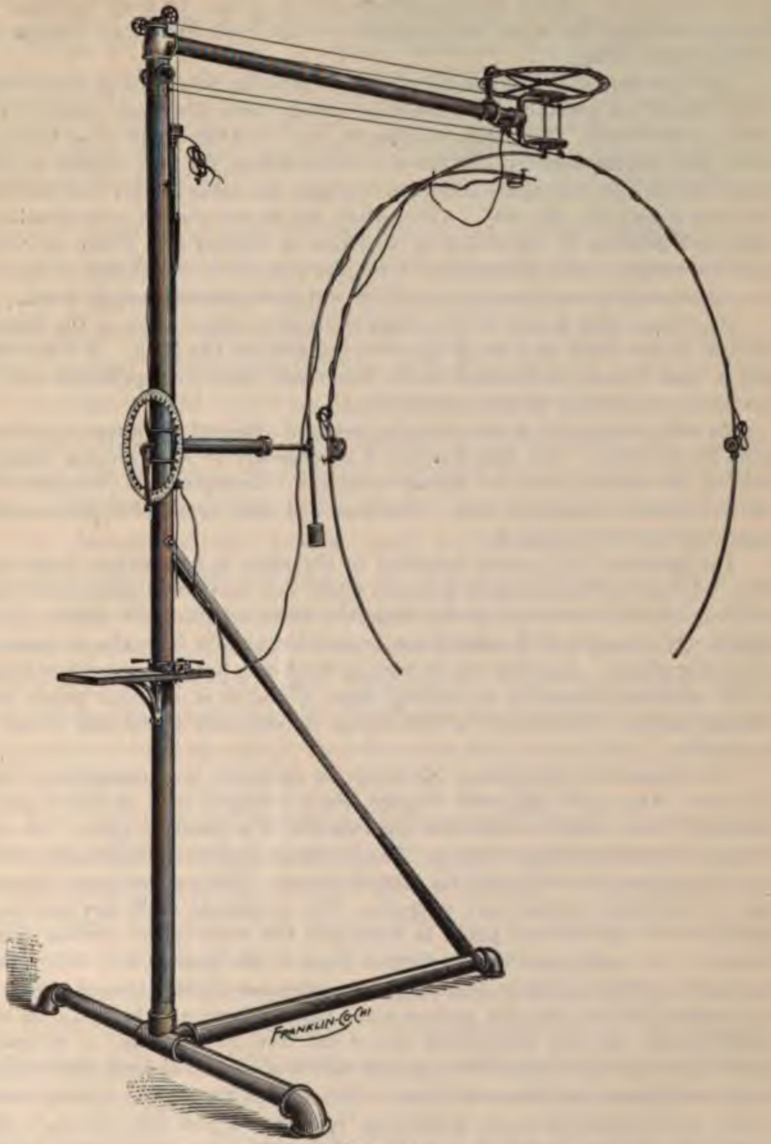


FIG. 1.

sphere. The arm is three meters long and slides freely in the horizontal direction.

For ordinary purposes only one receiver is needed on each arm, but it is evident that any number of receivers desired may be mounted on each arm for the purpose of special experiments. The receivers are clamped by a thumb screw and may be placed in any position on the arms. In order to eliminate conduction along the arms, the receivers are insulated from their clamps by means of soft rubber.

Soft and flexible wires run from the receivers to terminals on the surface of the frame and permanent wires are laid from these terminals, inside of the frame, to the tablet. The same curcuit is used for arms *C* and *D*, as they are never used simultaneously. There is a knife switch for each circuit on the tablet and all the circuits are completed through the same battery and mercury key (not shown in the cut). Thus, when the key is pressed, a click will be heard in a receiver if the switch in its circuit is closed; and if two or three switches remain closed at the same time, the current is distributed equally to the corresponding receivers and the clicks will occur simultaneously in all.

Resistance may be put in the main circuit or in one or more of the branch circuits, as the needs may be, to vary the intensity of the click. If a dry-battery is used it may be fastened to the frame and then the apparatus will be complete without any further accessories.

To vary the quality of the stimulus, tones of different pitch may be substituted for the click. For that purpose it is necessary to have electric tuning-forks of the desired pitch in a distant room and to complete the perimeter circuit as a shunt through the fork. The tone will then be heard in the receiver whenever the key is pressed.

The center of the sphere described by the arms is 1.73 meters above the floor. A high, adjustable stool is placed under this center and adjusted for the observer so that the center of the observer's head occupies the center of the sphere. If a head rest is used, great precaution should be taken to prevent disturbing effects. It is best not to use any head rest, but to check the position of the observer frequently by putting arms *A* and *B* at opposite points and sighting across. The height is determined by reference to the axis of arm *C* or arm *D*.

The scheme for numbering the points on the scale is of considerable importance. That plan has been adopted which students tend to follow spontaneously when asked to describe the location of a point in space. In this there is no number higher than 90. The upper scale gives the reading for horizontal planes and the side scale for vertical planes. The nomenclature adopted may be described without any diagram. The horizontal scale has two zero-points, one in the median plane in front and the other in the median plane behind; *i. e.*, every point in the median plane of the head is at 0° with reference to the horizontal plane of space, and degrees are counted toward the right and toward the left from the median plane both in front and behind. In the vertical scale, the two zero-points are at the level of the ears; *i, e.*, every point in the horizontal plane through the ears is at 0°, and degrees are counted upward and downward from this level. This gives a simple and natural nomenclature for direction, *e. g.*, a point is 'in front, 15° left and 25° up.' The upper scale may be turned so that this system will correspond to any desired position of the observer.

This apparatus will favor the use of the method of right and wrong cases and the method of minimal changes, in which it is not necessary for the observer to estimate degrees. However, it is sometimes advantageous to allow the observer to indicate the direction with a pointer; the experimenter may then swing the perimeter arms to such a point and read off the result on the scales.

This brief statement, supplemented by the figure, may suffice to give a general idea of the apparatus. Its special merits are, that it enables the experimenter to stand in one place throughout complicated series of experiments and operate all the parts of the apparatus without giving any suggestion by movement or delay, that the movable parts of the apparatus are made to act without sound or jar, and that it makes it possible to vary, measure, and control the essential factors. C. E. SEASHORE.

The perimeter was so located in an almost cubical room (20 ft. × 16 ft. × 13 ft., and containing only the necessary apparatus) that the center of the sphere described by its arms was equidistant from the walls of the room. In order to approximate perfect uniformity in the reflection of the sounds from all directions still further, the sounds were always given on the same side, and instead of swinging the arms of the perimeter to the different standards, the observers turned to the required standard positions. Following the adopted nomenclature of the perimeter, the points used as standards can be most easily located with reference to the accompanying diagram (Fig. 2). This diagram represents the right hemisphere. The letters uf, df, ub, db, rf, lf, rb, and lb stand for up front, down front, up back, down back, right front, left front, right back, and left back, respectively. To describe the position of a point, we mention first its plane and then its location in that plane, as for example, 30° u, 15° rf; or 15° d, 45° rb, etc.

The stimulus was furnished by an electric fork of 100 vibrations, in a distant room, kept vibrating by a current completing its circuit through the receivers of the perimeter. The sound thus heard from the receivers was favorable for localization and of sufficient strength to be heard 12–15 meters away.

The method followed is an abbreviated form of the method of right and wrong cases or 'Konstanzmethode' as Müller[1] prefers to call it. This method was preferred to the method of minimal change mainly because it gives more accurate and precise judgments. The stimuli were the same but were given in different positions with intervening time intervals which kept the mind more alert for minute distinctions than where a continuous stimulus moved along slowly until the observer called halt. In a few preliminary trials the failure of the method of minimal

---

[1] *Die Gesichtspunkte und die Tatsachen der Psychophysichen Methodik.*

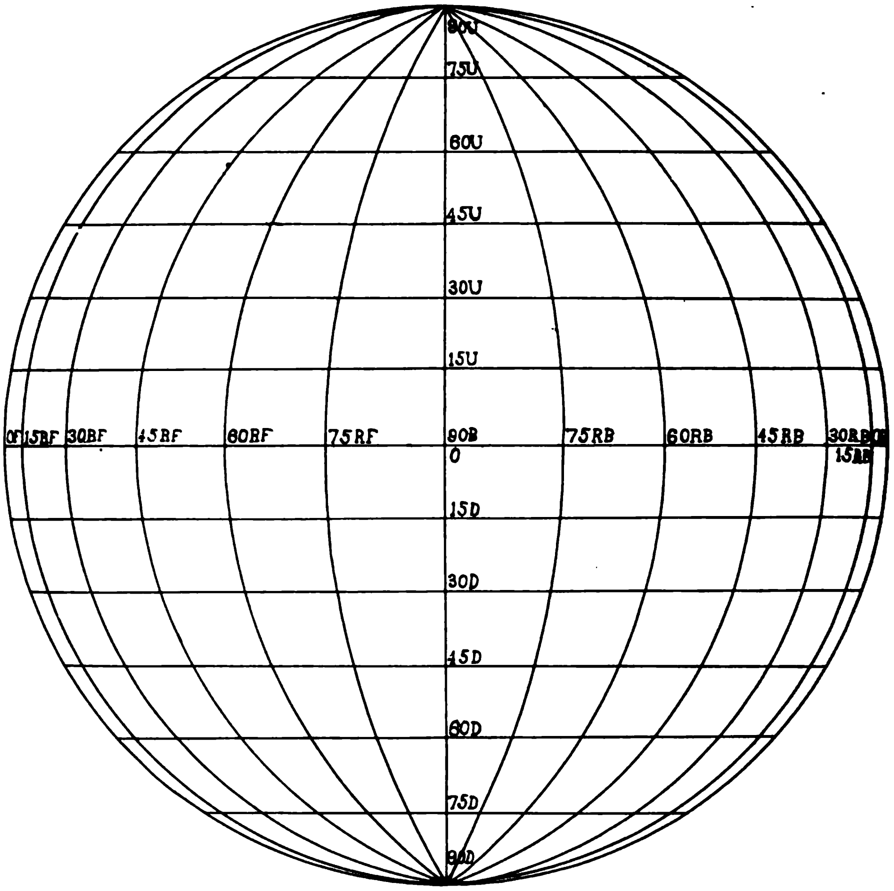


FIG. 2.

change to hold the attention of the observer and to suggest directly the contrast of different directions became evident.

The particular type of the Konstanzmethode that was adopted is the one which allows the observer to have choice between two alternatives only. The equality or doubtful judgment was not permitted. Elimination of that judgment greatly simplifies the computation and final evaluation of the results, and is an incitement to keep the observer aggressive. In the words of Professor Jastrow[1] the equality judgment 'encourages fatigue (weariness) and diminishes the regularity and simplicity of the judging process.' On the same point Whipple[1] says that the equality judgment induces the tendency 'to pronounce two impressions alike when the difference between them is not clearly made out.'

---

[1] 'Critique of Psychophysic Methods,' *Am. Journ. Psych.*, I., p. 283.

To illustrate the actual procedure of making the tests, let us suppose that we wish to take the record of the standard 0°f, horizontal plane through the aural axis. The observer is seated on the stool having his eyes closed and his head at the center of the sphere. With the receiver at the standard, 0°f, the experimenter presses the key twice in rapid succession giving two short sounds, each of which has a duration of about one fifth of a second, and the interval is also one fifth of a second. With the other hand he quickly moves the receiver 5° either right or left and there again gives the same double stimulus. The time interval between the two stimuli is about one second. The observer then gives his judgment by saying that the second stimulus is on one side or the other of the first one. If after all the trials with the interval, 5°, have been made, more than 90 per cent. of the judgments are correct, the next smaller interval, 3°, must be tried; or, if less than 60 per cent. are correct, the next larger interval, 10°, must be tried. If that is not sufficient, the interval may be increased 5° each time until the percentage of correct judgments lies within the limits.

The method was thus abbreviated in order to save time in experimentation. This was thought justifiable by the fact that at the beginning of each row of standards that are in the same plane the smallest interval was always tried first and, if that was not sufficient, large intervals were taken successively. The interval that was found satisfactory at a given standard was the one first employed at the following standard. But if this interval was not adequate there, a larger or smaller step was used as the case demanded. Prejudice that would be involved in the arbitrary selection of an interval for a given standard was thus avoided.

In order to have a uniform basis for evaluating the tests on all the standards, the threshold of discrimination for directions was found by the 'table for determining the probable error from the percentage of right cases and amount of difference.[1] On this basis the required interval for each standard was computed to make the per cent. of correct judgments 75.

---

[1] 'Discrimination of Clangs and Tones,' *Am. Journ. Psych.*, XII., p. 412.

Sixteen persons who may be divided into two groups took part as observers.[2] The four regular observers, *W*, *K* (women), *B*, and *S* (men), had considerable training in observing and in conducting psychological experiments. *K* and *B* had become familiar with these experiments through the preliminary tests. *W* is an instructor in the University and *K*, *B*, and *S* are graduate students in psychology. Each one gave fifty judgments at each standard. The additional observers who were employed in some special tests, *Wi*, *C* (women), *H*, *Ch*, *Kl*, *Sc*, *G*, *M*, *We*, *Se*, *Bu*, and *Ho* (men), are also students and are in a general way familiar with psychological experiments.

The eyes were not blindfolded (except in one case) but merely closed and no head rest was used to guard against possible disturbing effects from this source. The exact position of the observers was checked by sighting across small labels which were fastened on the walls of the room. In order to distribute the effect of practice, fatigue, etc., the tests of each individual were made in the double fatigue order. The test periods were never longer than an hour and were always at the same time of the day for each person. The experiments were made during the academic year 1903–4.

SERIES I. HORIZONTAL PLANES.

The immediate aim of this series was to measure the power of discrimination between directions of sounds in horizontal planes. The points or standards, ninety two in number, are located in the following planes (see Fig. 2): 0°, 15°u, 15°d, 30°u, 30°d, 45°u, 60°u, and 75°u, of which the last two have seven standards each, 30° apart, while the others have thirteen standards each, 15° apart.

Each of the four regular observers, *W*, *K*, *B*, and *S*, gave fifty judgments at each standard, passing through the entire series of points in the double fatigue order, which gives in all over 18,000 separate judgments.

---

[1] Fullerton and Cattell, *On the Perception of Small Differences*, p. 16. (Univ. Penn. Phil. Series, No. 2.)

[2] The writer wishes to express his thanks to the observers.

No extensive tests were made on the left side of the median plane for the reason that some tests made on both sides did not indicate any essential differences between the two sides.

The results are not given in statistics but in the form of curves, which seemed preferable. But to illustrate the statistical form of the records the following section is adduced.

HORIZONTAL PLANE 15°u.*

Standards.	0°f	15°rf	30°rf	45°rf	60°rf	75°rf	90°r
Intervals.	D3°	D3°	D3°	D3°	D3°	D3°	D3°
	x	I	I	x	I	x	x
	x	I	I	I	I	I	x
	I	x	I	I	I	I	I
	I	I	x	I	I	I	I
	I	I	I	I	I	x	I
	I	I	I	I	I	I	I
	I	I	I	I	x	I	x
	I	x	I	I	x	x	x
	I	I	I	x	x	x	I
	I	I	x	I	x	I	x
	I	I	I	I	I	I	I
	I	I	I	I	x	I	I
	I	I	I	x	x	x	I
	I	I	I	I	I	I	I
	I	I	I	I	I	x	I
	I	I	I	x	x	I	x
	I	I	I	x	I	I	I
	I	I	I	I	I	x	x
	I	x	I	I	x	x	I
	I	I	x	I	I	I	I
	I	I	I	I	I	I	x
	x	I	x	I	x	x	I
	I	I	I	x	I	I	x
	I	I	I	I	I	I	I
	I	I	I	I	I	x	x
	88%	88%	84%	76%	64%	60%	60%
Interval for 75%	1.7°	1.7°	2.0°	2.9°	5.7°	7.9°	7.9°

The broken lines in the charts represent graphically the accuracy of localization in the horizontal planes for each one of the four observers. The continuous line embodies the average of the four. The composite of the averages in which the details disappear has value only in so far as it is a means of comparison of general features. In these figures the radii represent the standard directions, the distances between the arcs represent degrees and the center of the arcs represents the center of the observer's head. Thus, if the curve passes through the intersection of the third semicircle with the radius 15°rf, it means that a sound must be 3° right or left of 15°rf to be perceived as coming from a point right or left of the standard. In those places where the curves go beyond the area of the charts the intersections are indicated by the angles which the curves make with the extended radii. It must be noted that a degree does not represent the same actual distance in all the planes. Its value is greatest in the horizontal plane through the aural axis, or equatorial plane, and is less for the others, namely:

In horizontal plane	0°		1° = 17.5	mm.
" " "	15°u	(or d)	1° = 16.9	"
" " "	30°u	"	1° = 15.2	"
" " "	45°u	"	1° = 12.4	"
" " "	60°u	"	1° = 8.8	"
" " "	75°u	"	1° = 4.5	"

Figs. 4–11 have been reduced on this scale so that 1 mm. of the radial distance is equal to 2.6 mm. of actual distance between two receivers, and these eight figures are on the same absolute scale. Fig. 3 is drawn on a much larger scale.

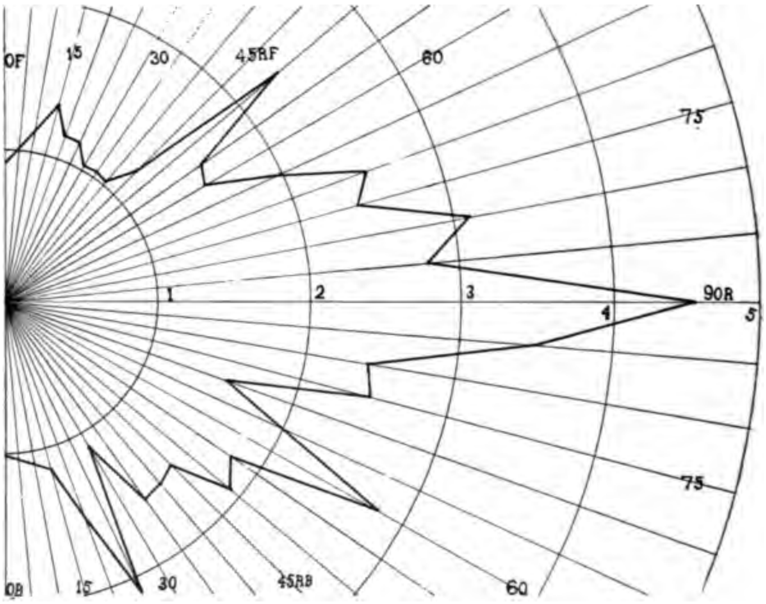


FIG. 3.

After the measurements in the horizontal planes had been completed it was thought desirable to make a more detailed investigation of a single curve. For this purpose the plane through the aural axis was chosen in which the thirty seven standards tested are only 5° apart. One of the four observers, *S*, was employed and gave 150 judgments at each point, in all 4,550 judgments. The curve based upon these measurements (Fig. 3) is more particularly referred to in the following.

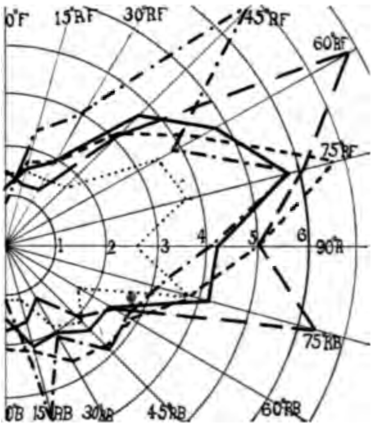


Fig. 4. Horizontal plane through the aural axis.

In Fig's 4–24, the four observers are represented by different forms of lines as follows: W ...., K ———, B - · - · - ·, S - - - -, composite ———.

Data in the Curves.

(*a*) In front, the localization is keenest. (*b*) In the back, it is nearly as keen. (*c*) At the side, it is least accurate. Then

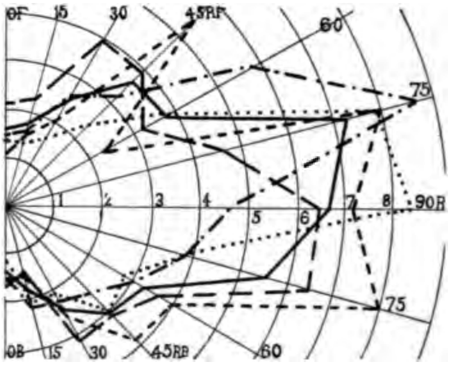


Fig. 5. Horizontal plane 15°u.

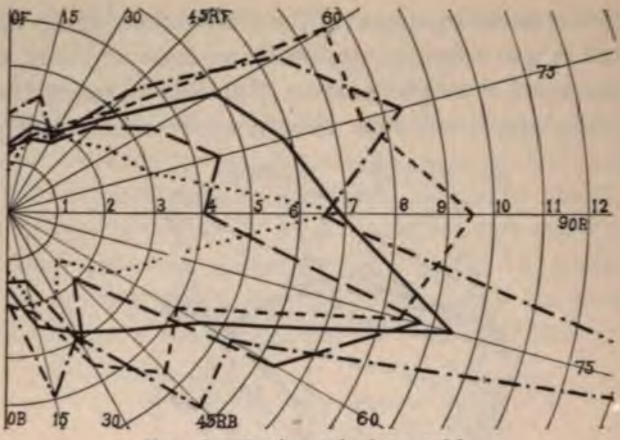


FIG. 6. Horizontal plane 15°d.

there are several prominences in the curves. Besides the large projection at 90°r there seem to be four quite conspicuous prominences (Fig. 3), at 15°rf, 25°rb, 50°rf, and 60°rb, which we shall designate for convenience P1, P1′, P2, and P2′, respectively, and the projection at 90°r we shall designate P3.

Glancing over the other curves we notice a quite general agreement with this one both in regard to the keenness of localization and in regard to the prominences. In Fig. 6, curve *B* and in Fig. 7, curve *K* are specially prominent illustrations of P1. In Fig. 4, curves *W* and *B* illustrate P1′. In Fig. 4, curves *B*, *S*, and *W* illustrate P2 and curves *W* and *S* illustrate P2′.

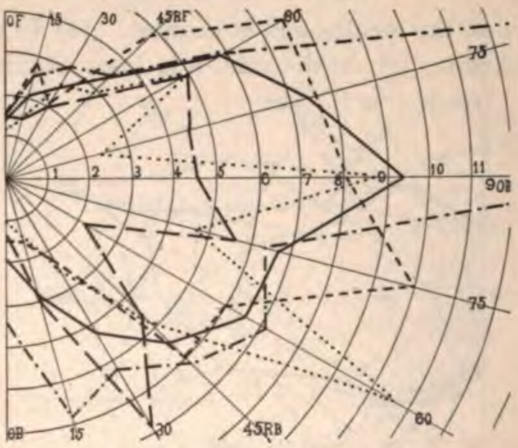


FIG. 7. Horizontal plane 30°u.

Discussion: Introspective and Theoretical.

Disturbing Elements. — It is necessary here to point to some items in the experiments which are disturbing elements, in the sense that they complicate the results and perhaps distort the real characteristics of the curves by obliterating or unduly accentuating the particular features. One element of this nature is what Kraepelin[1] calls 'Schwankungen der geistigen Leistungen.' He has shown that the mental capacity for doing work

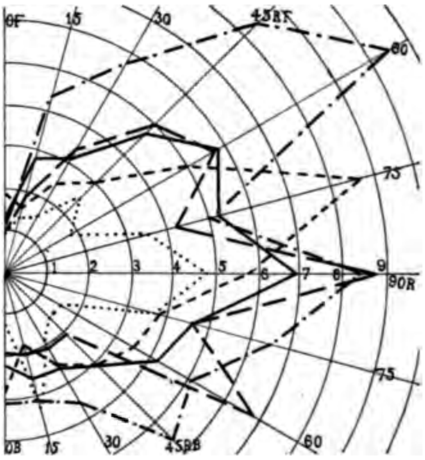


FIG. 8. **Horizontal plane 30°d.**

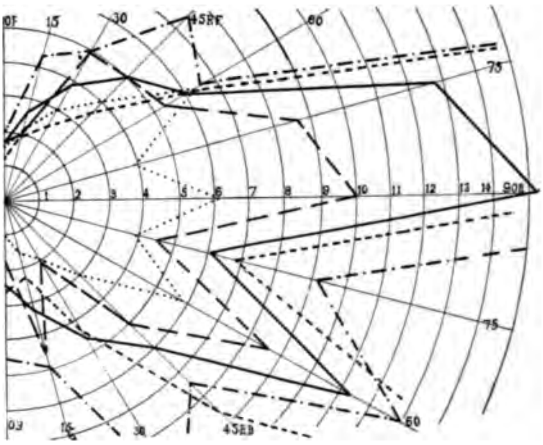


FIG. 9. **Horizontal plane 45°u.**

---

[1] Kraepelin, 'Die Arbeitscurve,' *Phil. Studien*, XIX., pp. 459–507.

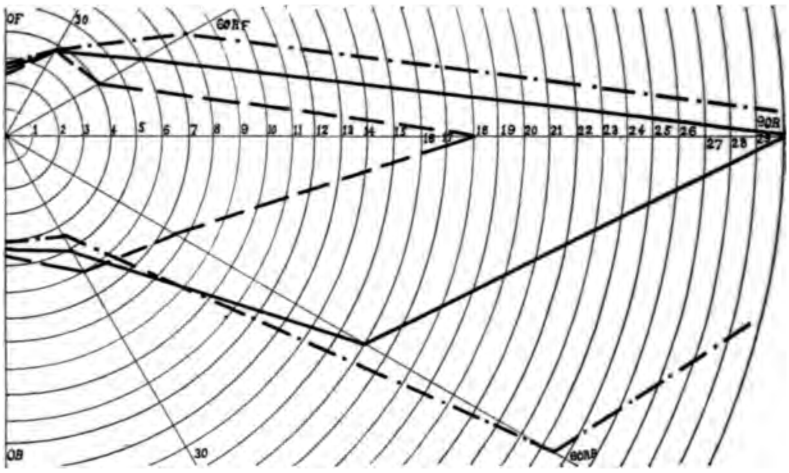


FIG. 10. **Horizontal plane 60°u.**

does not remain constant for any period of time. It fluctuates continually and the work accomplished varies accordingly. In addition to the variables which Kraepelin recognizes, there are constant tendencies to periodicity in continuous mental work, as has been demonstrated by Seashore and Kent. (See following article.)

All these fluctuations must be taken into consideration in

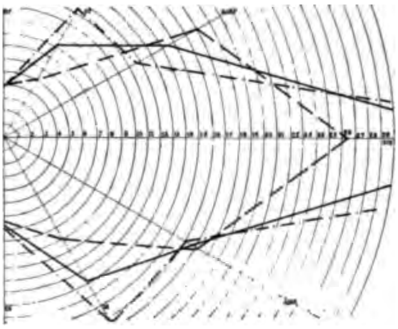


FIG. 11. **Horizontal plane 75°u.**

continuous mental work. The accuracy of discrimination varied with the wave of mental efficiency, other things being equal. That the mental conditions of the observers actually varied from standard to standard or from one group of standards to another is probably also implied in the fact that, after all the trials at a standard had been made, the observers repeatedly remarked that they thought the localization to be rather poor at that point because of their lack of attention, or, that the localization seemed easier on account of their being able to pay attention better. A deflection in the curve that would otherwise occur may at one time be lessened and at another time be accentuated by the changes in mental capacity according to the counteraction or the coöperation of the two.

The individuality of each observer must necessarily appear in the results. This has the tendency to hide the common, universal characteristics. Although the double fatigue order has on the whole a neutralizing effect for practice and fatigue, nevertheless the fact that different parts of the records were made at different times, and consequently under slightly different conditions is responsible for some accidental features. In fact the records show that occasionally there are quite noticeable differences between the records of the two orders for the same observer.

It was found that in the process of localization the actual comparison was not usually between the standard and the sounds at the side but chiefly between the two sounds on the sides. The images of the sounds continue for some time and the observer unconsciously disregards the standard after a few stimuli have been given, and the attention is directed rather toward the two sounds at the sides. This would tend to make the distance between the sounds on the two sides the threshold of discrimination, instead of the distance between the standard and the sound on a side. However, this scarcely detracts from the validity of the results since the relative accuracy of discrimination in the various directions is the important aim.

Localization in the Median Plane Belt. — The most noticeable feature in the curves is the keenness of localization in front and in the back. This seems to imply unmistakably, that the ability to discriminate directions of sounds depends to a large extent upon the relative intensities received by the two ears. A sound so situated that it may readily reach both ears will make a change in the ratio of the intensities easily perceptible and its direction, therefore; can be accurately perceived and easily distinguished from a sound coming from a slightly different direction. This is exactly the condition that obtains in the belt along the median plane. The points of and o°b in each one of the charts are particular cases of this condition. In this conection a conclusion by Matsumato[1] may have some bearing: "No sound on the right or the left side was localized in the median plane. * * * No sound in the median plane was localized on the right or left side of the plane." The same observation was mentioned by Preyer.[2]

That the localization should be more accurate in front than in the back is what might be expected and is in accordance with the law of economy. The pinnæ are so attached that sounds coming from the front are received more easily. Change in intensity as well as any qualitative variations can thus be perceived more favorably. We are also more accustomed to hear sounds in front so that our attention leads us to expect and to visualize more easily in front. Professor Seashore[3] says: 'We hear more sounds from objects that we pay attention to, *i. e.*, face, than from objects that we do not attend to, *i. e.*, those behind us.'

Münsterberg,[4] and later Bloch,[5] made experiments with a similar aim testing one plane, the horizontal plane through the aural axis. In regard to front and back our results agree with the figures of Bloch. On the other hand, Münsterberg's observer localized most accurately in front but less and less accurately toward the back where discrimination was minimal, which he considers in support of his theory of reflex movements.

Localization at the Side. — Certain prominences in the curves are mentioned above. They are seemingly not individual peculiarities since they occur in the curves of all the observers; nor is it probable that they are accidental since in the special curve (Fig. 3) in which the double fatigue order was repeated several times, starting at different points and going over the same ground six times (twenty-five judgments at a time at each standard), they became more conspicuous in each successive order while other irregularities tended to vanish. The question arises, to what are these prominences due? Let us see what the introspections of the observers may suggest.

---

[1] Matsumato, 'Researches on Acoustic Space,' *Studies Yale Psych. Laboratory*, 1897, V., p. 5.

[2] Preyer, 'Wahrnehmungen der Schallrichtung mittelst der Bogengänge,' *Archiv. f. d. ges. Physiol.*, 1887, XL., 568.

[3] *Univ. of Iowa Studies in Psych.*, 1900, II., p. 54.

[4] *Beiträge zur experimentellen Psychologie*, Heft 2, 'Raumsinn des Ohres. p. 220.

[5] Bloch, *Das binaurale Hören*, pp. 31, 35.

Introspective. — The following are some illustrations of frequently recurring remarks by the observers.

"At the standards 20°rf, 25°rf, 30°rf, 35°rf, and 40°rf the sounds on the right of the standard seemed slightly farther away. Then at standard 55°rf it seemed difficult to distinguish. At standards 65°rf and 70°rf the sounds toward the back seemed decidedly nearer. At 75°rf and 80°rf there was again no very definite means of localization. At 85°rb, 80°rb, 75°rb, and 65°rb the sounds toward the front seemed stronger and nearer. At 60°rb it again seemed difficult to distinguish the directions."

"It seemed especially difficult to localize at standard 25°rb. There was apparently no means of discrimination."

Standard 45°rf. "There is a difference in quality. Those toward the back have lower partials and are richer while those toward the front are thinner."

Standard 75°rf. "Those toward the back seem nearer and those toward the front seem farther away and thinner."

Standard 75°rb. "Those toward the back seem thinner."

Standard 60°rb. "The sounds toward the back are lower."

Standards 60°rb, 45°rb, and 30°rb. "In nearly all trials the sounds back of the standards seemed thinner as if heard 'around the corner of a building' in comparison with those in front of the standards."

These quotations from the records serve to make some, though not very definite, suggestions. (*a*) There seem to be certain directions where the localization is more difficult than in others, apparently because there is no means of discrimination. (*b*) There are relative differences in intensity for different directions. (*c*) Although the sounds were objectively at the same distances for all directions the observers felt quite sure that they did not seem to be at the same distances. (*d*) Then, variations in pitch, richness of sound, etc., are mentioned.

In order to determine more precisely the significance of these data and, if possible, to find new elements, a special set of tests was made upon four other observers *Wi*, *H*, *Ch*, and *Kl*, who were entirely ignorant of the results thus far obtained. Three typical standards were chosen namely, 45°rf, 90°r, and 45°rb, in each one of three horizontal planes, 30°d, 0°, and 30°u.

The apparatus was the same as in the regular experiments but the method was slightly different. The standard was given

TABLE I.

STANDARD 45°RF IN EACH OF THE THREE PLANES.

Observer.	Planes.	Forward.							Backward.						
		Fainter.	Further.	Less Clear.	Pitch.		Richer.	Misplacement.	Louder.	Nearer.	Clearer.	Pitch.		Thinner.	Misplacement.
					h.	l.						h.	l.		
Wi	30°u	4(1)		2		2			1(4)	(1)			3		
	0°	(2)	2						4	1	1	2	1		1u
	30°d	2(1)	1	(2)		3			2(1)		1	1	2		
H	30°u	(4)											4		2d
	0°				5				2		1		2		
	30°d	(3)			1			2u			1		4		
Ch	30° u		1(2)		3			2u 1d		1(5)			2		1u
	0°		1(2)		2				1				4		
	30°d	(1)	1		4			3u	3				4		1u
Kl	30°u	(1)	1					3u	(3)				2		3d
	0°	4						2u	5						1d
	30°d	(1)	(4)					2u	4	3					1d
		10(14)	7(8)	2(2)	16	6			22(8)	5(6)	4	3	28		

The numbers in parenthesis indicate the judgments that were contrary to the column under which they are given.

TABLE II.

STANDARD 45°RB IN EACH OF THE THREE PLANES.

Observer.	Planes.	Forward.							Backward.						
		Louder.	Nearer.	Clearer.	Pitch.		Richer.	Misplacement.	Fainter.	Further.	Less Clear.	Pitch.		Thinner.	Misplacement.
					h.	l.						h.	l.		
Wi	30°u	4		3	1	1			4(1)				2		
	0°	4	3		2			1u	2(1)	2(1			4		
	30°d	5(1)		1	1	1	1		3(1)						
H	30°u	3			2								4		1d
	0°	3		3	2		1				(2)		3		
	30°d	2		2	3		1						3		3d
Ch	30°u	2						3u 1d					3		5d
	0°	3	1		1	2			(1)	2		1(?)	2		
	30°d	3		1		1			(1)	1(1)		1			2d 1u
Kl	30°u	4		1				5u	(4)		1(1)		2		1d
	0°	5		1				3u	(2)(?)						3d
	30°d	3	5	1				2u		5					
		41(1)	9	13	12	5	3		9(11)	10(2)	1(3)	2	23		

and then a sound on one of the two sides so far from the standard that the observer could easily tell its direction, which was in each case determined by a few preliminary trials. Each observer gave ten judgments at each standard. Before the tests were begun, the observer was told to describe as accurately and carefully as he could the differences that he noticed between the sounds from the directions under comparison at any given trial. The results thus obtained are given in the tables.

TABLE III.

STANDARD 90°R IN EACH OF THE THREE PLANES.

Observer.	Planes.	Forward.										Backward.									
		Intensity.		Distance.		Clearness.		Pitch.		Richness.	Misplacement.	Intensity.		Distance.		Clearness.		Pitch.		Richness.	Misplacement.
		m.	l.	m.	l.	m.	l.	h.	l.	m.l.		m.	l.	m.	l.	m.	l.	h.	l.	m. l.	
	30°u	1	4			1							5								2u
Wi	0°	3	1		1			3		1	2u	4	1						4		1u
	30°d	5			1	1			2				5	1			1		5		
	30°u	3				1		2			1u	1				1			3		
H	0°	2				1		1				1							4		
	30°d	3				1		2											3		2d
	30°u								2		3u 2d	1							1		3d 1u
Ch	0°	2			2			1				2			2				3		
	30°d	2			1			2			1u	1					1		5		
	30°u	1			2	1					4d			1			1				4u 1d
Kl	0°	2	3	3								4									3d
	30°d	2			3										1				1		4d
		26	8	3	10	6		11	4	1		14	11	2	3	1	3		29		

(*a*) Intensity is the most prominent feature. In Table I. we notice that under the rubric *backward* twenty-two are said to be louder and eight fainter. In Table II. under *forward*, forty-one are louder and one fainter. In Table I. (standard 45°rf), *backward* means nearer to the aural axis and, in Table II. (standard 45°rb), *forward* means nearer to the aural axis. This indicates that for these particular positions sounds nearer the aural axis seem more intense. On the other hand, in Table I. under *forward*, *i. e.*, farther from the aural axis, ten are fainter and fourteen louder; and in Table II., under *backward*, *i. e.*, farther from the aural axis, nine are fainter and eleven louder. There is no definite inclination for the converse of the above statement, that sounds farther from the aural axis seem less intense. But the implication probably is that the statement, the nearer a sound is to the aural axis the louder it seems, is true only for the immediate vicinity of the aural axis, and that if we go beyond certain limits the opposite may possibly be true as one of the quoted introspections indicates. In Table III. (standard 90°r), under *forward*, twenty-six are louder and eight fainter. The tendency seems to be to designate those *forward* as louder. Hence the point where a sound seems loudest, *i. e.*, the subjective aural axis, is probably farther forward than the objective aural axis.

(*b*) Distance is frequently mentioned. On the ground that change in intensity signifies change in distance, the figures under this head in the tables would have the same meaning as the figures under intensity. Sounds nearer the aural axis seem nearer to the head than those farther away from the axis.

(*c*) Clearness and richness are also spoken of, and here as for intensity and distance sounds nearer the aural axis are clearer and richer.

(*d*) In each table it may be noticed that the sounds *forward* are said to be higher in pitch and those *backward* are said to be lower. What this item means is not entirely clear. It may be that under it other elements are included which the observers could not very well designate by any other name, or the word forward may suggest higher and the word backward lower pitch.

(*e*) There are two kinds of misplacements, upward and downward, most of which become intelligible when we reduce them to terms of distance or intensity. For example, if, at the standard in the front upper quadrant, the sound *forward* is said to be up, or the one *backward* is said to be *downward*, it probably means that it seems farther or nearer respectively. But knowledge of the positions of the sounds tells that it is neither farther nor nearer in a radial direction, therefore it is shifted up or down. Most of the misplacements are probably accounted for upon this basis. However some may be due to other causes such as expectation and other differences in subjective and objective conditions.

Since it has been shown that distance (or intensity) is a potent factor in localization, another brief set of experiments was planned with the view to specify it more definitely. Again the same apparatus was used. Five observers, M, We, Se, Bu, and Ho, who were entirely naïve in regard to the structure of the apparatus and the method of experimentation and its purpose were engaged. Before the observer was brought to the apparatus he was blindfolded to avoid suggestions that might be gained from the structure of the apparatus. The observer was seated in the regular position within the perimeter; a sound was given in front and then the receiver was moved to one of the regular standards (horizontal plane through the aural axis) in the right front quadrant and there another sound was given. The observer then, not knowing that the sounds were actually at the same distances, estimated in inches the comparative distances of the two sounds. It was not prohibited to judge them to be at the same distance. This was repeated five times for each standard by each observer.

In a similar manner tests were made in the rear quadrant where the comparison, however, was with the sound directly back instead of in front. The essential aim was to make a distance comparison of all directions with one direction.

TABLE IV.

	0°f In.	15°rf In.	0°f In.	30°rf In.	0°f In.	45°rf In.	0°f In.	60°rf In.	0°f In.	75°rf In.	0°f In.	90°r In.
Bu	37	42	38	39	35	43	36	40	36	38	36	40
Se	28	31	26	27	28	26	25	26	22	20	27	20
Ho	26	23	22	22	24	24	35	26	27	17	38	28
We	23	32	22	33	24	29	22	28	23	33	24	33
M	32	33	37	39	39	38	36	37	35	30	35	29

	0°b In.	75°rb In.	0°b In.	60°rb In.	0°b In.	45°rb In.	0°b In.	30°rb In.	0°b In.	15°rb In.
Bu	53	48	48	45	48	48	44	46	43	41
Se	27	24	26	25	28	26	23	25	26	29
Ho	32	26	42	30	36	32	29	31	30	32
We	24	32	22	37	24	31	22	30	23	32
M	38	35	39	36	37	41	34	38	36	38

	0°f In.	15°rf In.	30°rf In.	45°rf In.	60°rf In	75°rf In.	90°r In.	75°rb In.	60°r b In.	45°rb In.	30°rb In.	15°rb In.	0°b In
Bu	40	45.4	41.1	49.1	44.4	42.2	44.4	36.3	37.5	40.0	41.8	38.1	40
Se	40	44.3	41.5	37.1	41.6	36.3	29.6	35.5	38.4	37.1	43.4	44.6	40
Ho	40	35.4	40.4	40.0	29.7	25.2	29.5	32.5	28.6	35.5	42.8	42.7	40
We	40	55.6	60.0	48.3	50.9	57.4	55.0	53.3	67.3	51.7	54.5	55.6	40
M	40	41.3	42.1	39.0	41.1	34.3	33.1	36.8	36.8	44.3	44.7	42.2	40
Av.	40	44.4	44.7	42.7	41.5	39.1	38.3	38.9	41.7	41.7	45.4	44.6	40

The results are shown in Table IV. The upper portion of the table gives the averages of the estimates of each observer. In the lower section the ratios of the pairs of comparison are reduced to the basis of 40 inches, the actual distance of the sounds. For example the first observer's estimate 0°f 37 and 15°rf 42; then, 37 : 42 : : 40 : 45.4, etc.

These figures are represented graphically by Fig. 12.

(*a*) Sounds are judged nearer in three places, in front, in the back, and at the side.

(*b*) Between these regions, about the middle of each quadrant, they seem farthest away.

Theoretical.—It remains to establish a connection, if possible, between the introspections, the results of the special tests, and the prominences in the curves.

Since in some directions sounds seem nearer and stronger than in others, and since there seem to be differences in quality for different directions; in short, since there are variations in the data upon which the localization depends, it seems reasonable to infer that there must be corresponding changes in the process of discrimination of directions. It has been stated that in front localization depends upon the relative intensities received by the two ears and that here a sound seems nearer than an equidistant sound farther toward the right. If a sounding receiver be moved from 0°f toward the right it apparently recedes at the same time, seeming to be farthest away about the middle of the quadrant.

This leads to the assumption that there is a change in the basis of localization from the condition in which sounds compared at any one time are seemingly at the same distance and of the same intensity to the condition in which the sound at the right of the standard appears farther away.

Now if the receiver be moved still farther to the right it will again seem to approach and become more intense, reaching its greatest intensity at or near the aural axis. A sound farther toward the right would now be stronger and nearer than one not so far toward the right, which would effect another change in the method of localization. Besides, there is here also the addition of qualitative elements. Sounds nearer to the aural

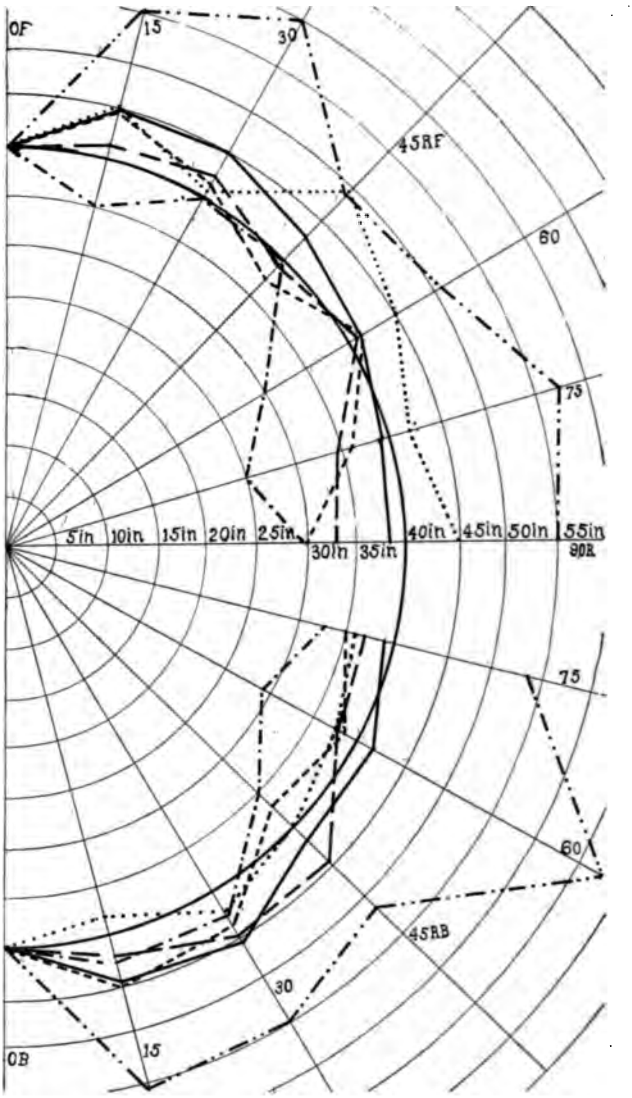


FIG. 12.

Bu·····, Se-----, Ho-·-·-·-, We-··-··-, M----, **composite** ———.

axis seem stronger, nearer, clearer, and richer than those not so near to it. That is, the localization in this region ceases to

be binaural and becomes monaural.[1] The localization of sounds coming from the front or near the front depends, in individuals having both ears normal, upon the coördinating function of the two ears. But sounds here at the side are not distinguished from one another by this combined action alone. The left ear drops out of service and the right ear becomes the chief means of perceiving the sounds. Those from the right side do not, in the nature of the case, reach the left ear as directly as from points in or near the median plane. It cannot be otherwise than that a sound on the side is stronger to the ear on that side. Frequently the observers remarked in passing from one standard to another in the locality of this transition, as for example at 45°rf or 60°rf, that there the sounds were very strongly perceptible to the right ear. The more favorably an ear can receive a sound the more responsible that ear is for a correct localization. Qualitative and quantitative features are among the determining elements or local signs of direction.

The modifying effect of the pinna and side of the head become influential. The function of the former is twofold, positive and negative: positive in aiding the passage of sound waves to the meatus, negative in obstructing the course of sound waves. The more favorably a sound is situated to reach the meatus the more forcible, complete and full will it be. This fact was well illustrated by the pseudophone of S. P. Thompson.[2] His conclusion is that the 'intensity of a perceived sound depends upon the amount of space over which the waves are gathered by the external collecting apparatus of the ear; and by analogy with optical phenomena we may say it depends upon the number of rays of sound which reach the ear.'

As we pass the aural axis the sounds farther forward, instead of backward as before, seem louder and more distinct. Hence there is a third transition point at the subjective aural axis. In the rear quadrant sounds seem most distant about the middle of the quadrant and, corresponding to the two transition points in the front quadrant, there are two in the rear quadrant since the conditions of localization are practically the same at ob as at of.

---

[1] The terms binaural and monaural are not used in their ordinary absolute meaning.

[2] Thompson, 'The Pseudophone.' *Phil. Mag.*, VIII., 1879, pp. 385–390.

In all there are five transition points (T). The first T1, lies between 0°f and 45°rf, the second, T1′, is located symmetrically in the rear quadrant, the third, T2, and the fourth, T2′, are near or just beyond the middle of the quadrants, and the fifth, T3, is at the aural axis. T1 is essentially a change in binaural localization 'from the condition in which sounds compared are seemingly at the same distance and of the same intensity to the condition in which the sound at the right of the standard appears more distant.' T2 is essentially a transition from binaural to monaural localization. T3 is a change in monaural localization, *i. e.*, a reversal of the monaural process. More will be said below in regard to this transition point. T2′ and T1′ are reversals of T2 and T1 respectively.

The positions of the transition points correspond to the positions of the prominences in the curves. T1 corresponds to P1, T1′ to P1′, T2 to P2, T2′ to P2′, and T3 to P3. Now, the relation between the two is in the fact that change in the data and elementary processes involved in localization, *i.e.*, change in the basis of discrimination must cause more or less confusion on the part of the observer. In several of the introspections the observation is made that at some standards it was especially difficult to localize. It may be noticed that these directions correspond to the positions of the prominences. That these transitions resulted in confusion is further supported by the introspective remark of the observers that a definite distinction could be noticed between the standard and the sound compared with it but that the observer could not tell with certainty on which side of the standard the second sound was. Consequently more errors were made, and hence the prominences in the curves. But in a large number of trials the observer soon learned to interpret these distinctions correctly, in part at least. In other words he became adapted to the modified method. That such adaptation actually occurred is quite apparent from the distribution of the errors in the records. In 75 per cent. of all such transitions the records show that nearly all errors made at a standard were made in the first half of all the trials made with that standard. This clearly indicates that in the second half the observer had learned to interpret more correctly the

distinctions that were already recognized in the first half but not understood.

In regard to P3 it should be mentioned that beside the fact that it is a transition, there is another condition involved. There must be a point in the aural axis or thereabouts where the coördinating function of the two ears reaches its minimum, or where monaural localization reaches its maximum. If the two ears render any assistance to each other in the perception of direction there must be a point where this mutual effect is least, and consequently tends to make discrimination less accurate. Then there is also the presence of confusion points. A telephone moving from front toward back comes to a position in or near the aural axis where it has its greatest monaural intensity. The locus of this point at different distances from the head was above designated as the subjective aural axis. If the monaural intensity is maximal in the subjective aural axis there must be, for each point on one side of the axis, a point on the opposite side of the axis with similar characteristics. That is, a sound near the subjective aural axis permits of more than one interpretation in terms of perception, and hence a system of confusion points.

In recent years, the so-called secondary, qualitative factors have been recognized as important elements of localization. Intensity was held as a very essential factor but recent investigations[1] show that we are not justified in laying so much emphasis upon it. Intensity alone is not sufficient to account for all the features of localization. The fact that monaural localization has been demonstrated indicates a more complicated basis for the perceiving of direction of sounds. Careful observation and introspection point to the presence and importance of qualitative data in the process of localization.

Referring again to the curve of Bloch, we find that it does not indicate any prominences or deflections beyond the general fact of poorer discrimination at the side. The chief reason for this is that the standards which he tested are farther apart,

namely 22.5°. In the charts, with standards 15° apart, the prominences do not appear so regularly as in Fig. 3, with standards, 5° apart.

---

[1] Angell and Fite, 'Monaural Localization of Sound,' PSYCH. REV., 1901, VIII., pp. 225–246; pp. 449–458.

Angell, 'Significance of Partial Tones,' PSYCH. REV., 1903, X., pp. 1–14. Pierce, *Studies in Space Perception.*

SERIES II. VERTICAL PLANES.

The immediate aim of this series is to determine the power of discrimination between directions of sounds in vertical planes.

The apparatus and its arrangements are exactly the same as in the first series with one exception. It was possible in the first series to procure uniformity in the reflection of sounds by keeping the source of the sound in the same locality and allowing the observer to take different positions for the various standards. This could not be done in the vertical measurements. To overcome this difficulty a screen was devised consisting of a frame built of iron pipes over which a canvass was stretched. The screen thus constructed had the shape of a hollow cylinder 3.40 meters in diameter and 2.70 meters in length. It was so situated with reference to the perimeter that the center of the

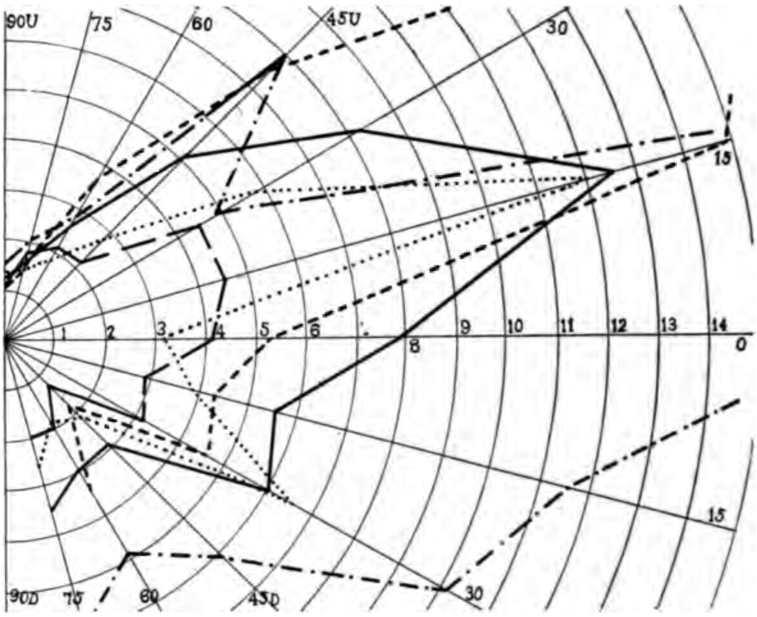


FIG. 13. Vertical plane 90°r.

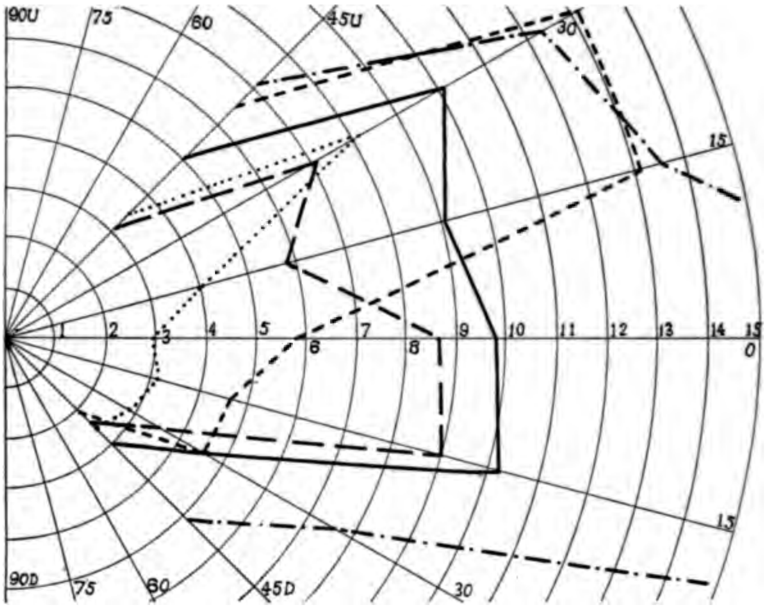


FIG. 14. Vertical plane 75°rf.

sphere described by the arms of the perimeter coincided with the center of the cylindrical screen.

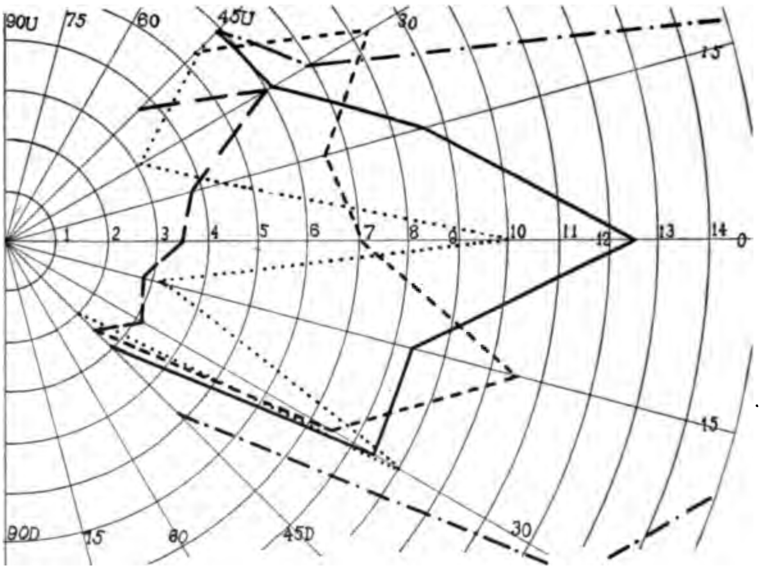


FIG. 15. Vertical plane 75°rb.

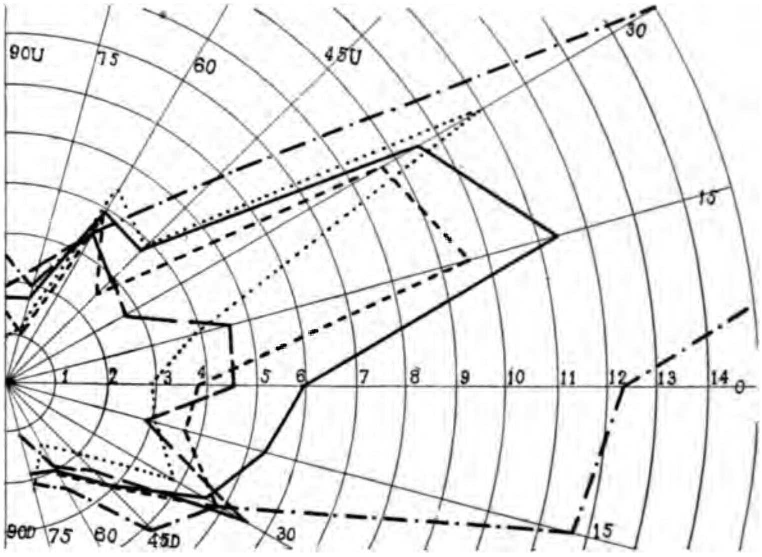


FIG. 16. **Vertical plane 60°rf.**

A brief but careful test was made of one of the vertical planes to discover whether the screen would be sufficient to give uniform reflection. The observer took a horizontal position on

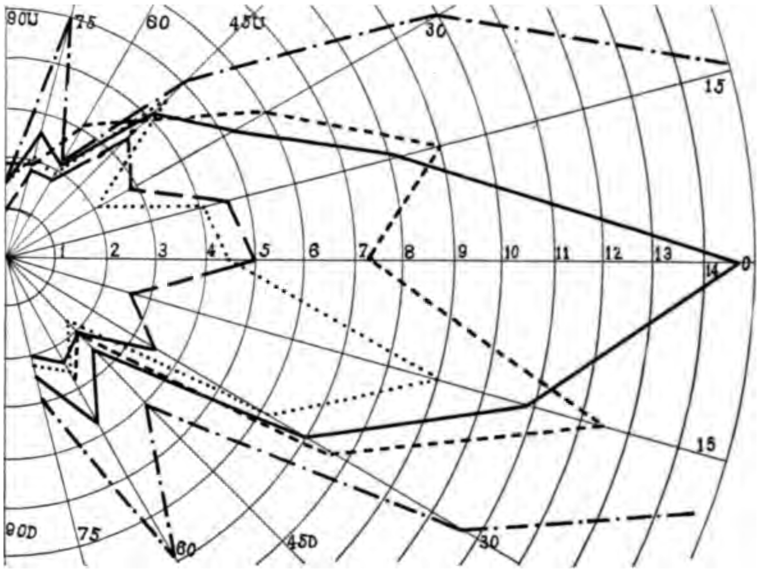


FIG. 17. **Vertical plane 60°rb.**

obtained when the screen was used and the observers had the upright position.

The standards, one hundred and twenty-five in number, are in the following vertical planes (see Fig. 2): 90°r, 75°rf, 75°rb, 60°rf, 60°rb, 45°rf, 45°rb, 30°rf, 30°rb, 15°rf, 15°rb, and the median plane. The planes 90°r, 60°rf, 60°rb, 30°rf, 30°rb, have twelve standards each, 15° apart. The point 90° down was not tested. The planes 75°rf, 75°rb, 45°rf, 45°rb, 15°rf, and 15°rb, have seven standards each, 15° apart and ranging from 45°u to 45°d. In the median plane are twenty-three standards.

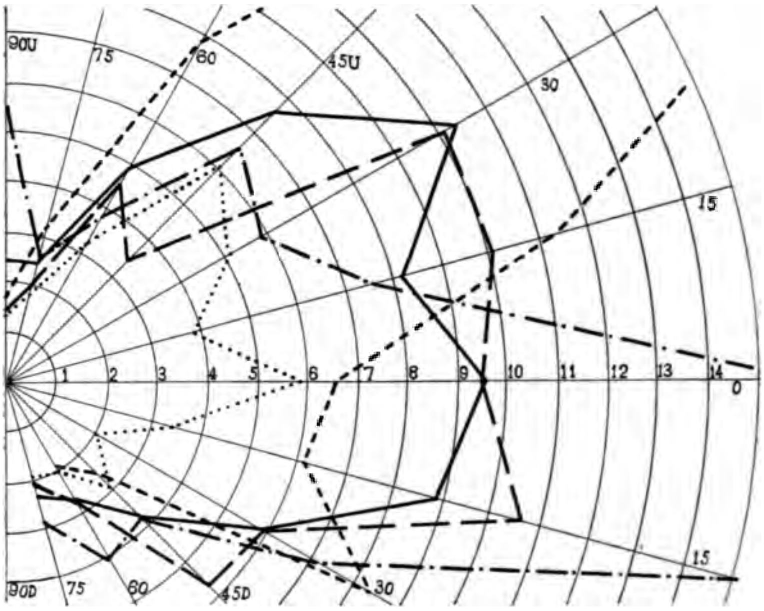


FIG. 20. Vertical plane 30°rf.

Each of the four regular observers, *W*, *K*, *B*, and *S*, gave fifty judgments at each standard passing through the entire series of points in the double fatigue order, which gives in all about 25,000 judgments.

The charts are constructed on the same principle as in the foregoing series but here a degree has the same distance-value throughout, namely, 17.5 mm.

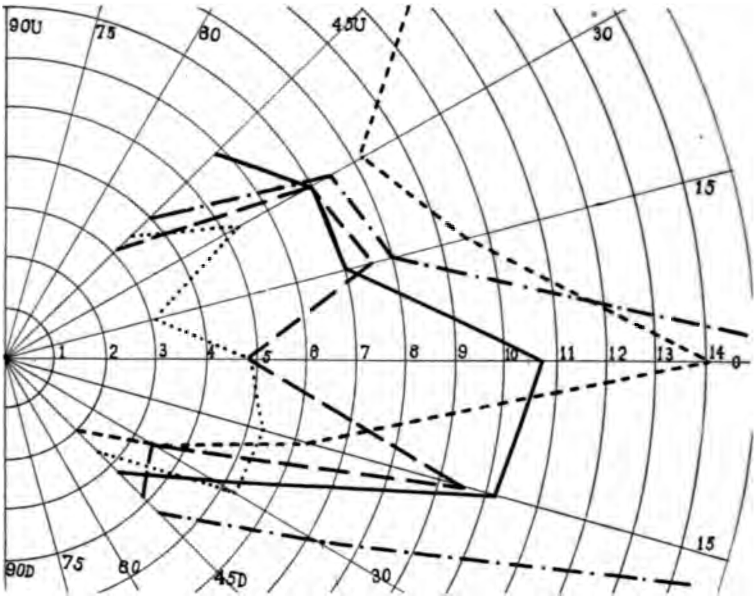


FIG. 18. Vertical plane 45°rf.

a bench constructed with as little material as possible. The stimuli were given in the same manner and locality as in Series I. The results indicated no essential deviation from those

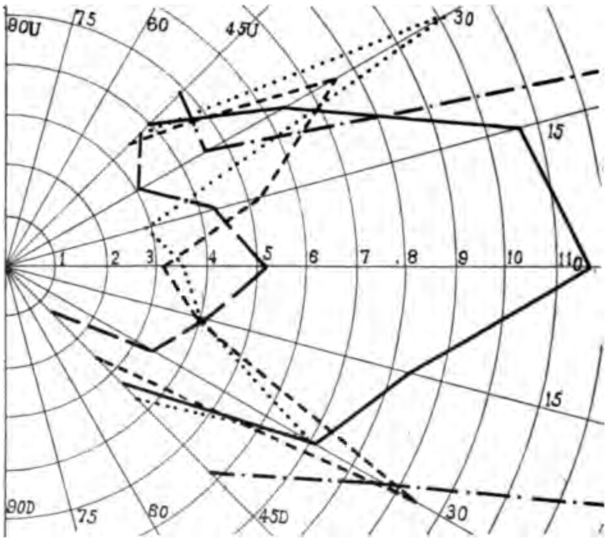


FIG. 19. Vertical plane 45°rb.

obtained when the screen was used and the observers had the upright position.

The standards, one hundred and twenty-five in number, are in the following vertical planes (see Fig. 2): 90°r, 75°rf, 75°rb, 60°rf, 60°rb, 45°rf, 45°rb, 30°rf, 30°rb, 15°rf, 15°rb, and the median plane. The planes 90°r, 60°rf, 60°rb, 30°rf, 30°rb, have twelve standards each, 15° apart. The point 90° down was not tested. The planes 75°rf, 75°rb, 45°rf, 45°rb, 15°rf, and 15°rb, have seven standards each, 15° apart and ranging from 45°u to 45°d. In the median plane are twenty-three standards.

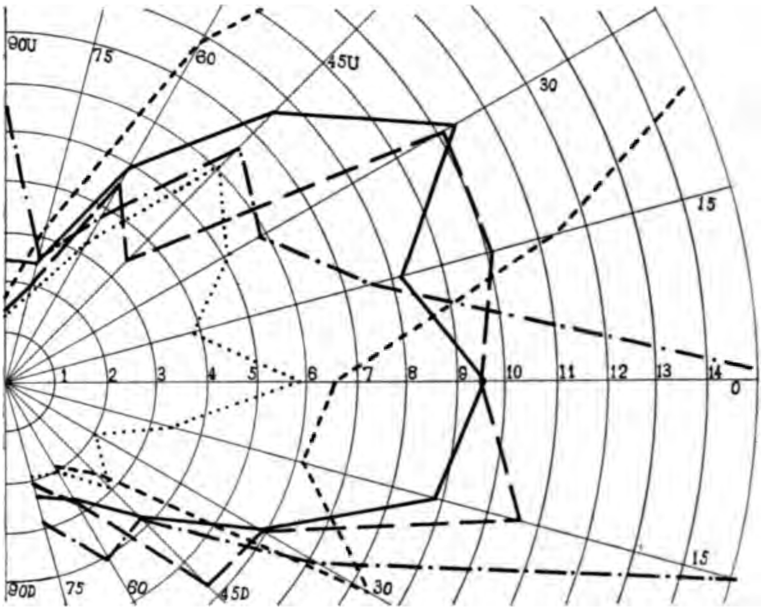


FIG. 20. Vertical plane 30°rf.

Each of the four regular observers, *W*, *K*, *B*, and *S*, gave fifty judgments at each standard passing through the entire series of points in the double fatigue order, which gives in all about 25,000 judgments.

The charts are constructed on the same principle as in the foregoing series but here a degree has the same distance-value throughout, namely, 17.5 mm.

be binaural and becomes monaural.[1] The localization of sounds coming from the front or near the front depends, in individuals having both ears normal, upon the coördinating function of the two ears. But sounds here at the side are not distinguished from one another by this combined action alone. The left ear drops out of service and the right ear becomes the chief means of perceiving the sounds. Those from the right side do not, in the nature of the case, reach the left ear as directly as from points in or near the median plane. It cannot be otherwise than that a sound on the side is stronger to the ear on that side. Frequently the observers remarked in passing from one standard to another in the locality of this transition, as for example at 45°rf or 60°rf, that there the sounds were very strongly perceptible to the right ear. The more favorably an ear can receive a sound the more responsible that ear is for a correct localization. Qualitative and quantitative features are among the determining elements or local signs of direction.

The modifying effect of the pinna and side of the head become influential. The function of the former is twofold, positive and negative: positive in aiding the passage of sound waves to the meatus, negative in obstructing the course of sound waves. The more favorably a sound is situated to reach the meatus the more forcible, complete and full will it be. This fact was well illustrated by the pseudophone of S. P. Thompson.[2] His conclusion is that the 'intensity of a perceived sound depends upon the amount of space over which the waves are gathered by the external collecting apparatus of the ear; and by analogy with optical phenomena we may say it depends upon the number of rays of sound which reach the ear.'

As we pass the aural axis the sounds farther forward, instead of backward as before, seem louder and more distinct. Hence there is a third transition point at the subjective aural axis. In the rear quadrant sounds seem most distant about the middle of the quadrant and, corresponding to the two transition points in the front quadrant, there are two in the rear quadrant since the conditions of localization are practically the same at ob as at of.

---

[1] The terms binaural and monaural are not used in their ordinary absolute meaning.

[2] Thompson, 'The Pseudophone.' *Phil. Mag.*, VIII., 1879, pp. 385–390.

In all there are five transition points (T). The first T1, lies between 0°f and 45°rf, the second, T1′, is located symmetrically in the rear quadrant, the third, T2, and the fourth, T2′, are near or just beyond the middle of the quadrants, and the fifth, T3, is at the aural axis. T1 is essentially a change in binaural localization 'from the condition in which sounds compared are seemingly at the same distance and of the same intensity to the condition in which the sound at the right of the standard appears more distant.' T2 is essentially a transition from binaural to monaural localization. T3 is a change in monaural localization, *i. e.*, a reversal of the monaural process. More will be said below in regard to this transition point. T2′ and T1′ are reversals of T2 and T1 respectively.

The positions of the transition points correspond to the positions of the prominences in the curves. T1 corresponds to P1, T1′ to P1′, T2 to P2, T2′ to P2′, and T3 to P3. Now, the relation between the two is in the fact that change in the data and elementary processes involved in localization, *i.e.*, change in the basis of discrimination must cause more or less confusion on the part of the observer. In several of the introspections the observation is made that at some standards it was especially difficult to localize. It may be noticed that these directions correspond to the positions of the prominences. That these transitions resulted in confusion is further supported by the introspective remark of the observers that a definite distinction could be noticed between the standard and the sound compared with it but that the observer could not tell with certainty on which side of the standard the second sound was. Consequently more errors were made, and hence the prominences in the curves. But in a large number of trials the observer soon learned to interpret these distinctions correctly, in part at least. In other words he became adapted to the modified method. That such adaptation actually occurred is quite apparent from the distribution of the errors in the records. In 75 per cent. of all such transitions the records show that nearly all errors made at a standard were made in the first half of all the trials made with that standard. This clearly indicates that in the second half the observer had learned to interpret more correctly the

distinctions that were already recognized in the first half but not understood.

In regard to P3 it should be mentioned that beside the fact that it is a transition, there is another condition involved. There must be a point in the aural axis or thereabouts where the coördinating function of the two ears reaches its minimum, or where monaural localization reaches its maximum. If the two ears render any assistance to each other in the perception of direction there must be a point where this mutual effect is least, and consequently tends to make discrimination less accurate. Then there is also the presence of confusion points. A telephone moving from front toward back comes to a position in or near the aural axis where it has its greatest monaural intensity. The locus of this point at different distances from the head was above designated as the subjective aural axis. If the monaural intensity is maximal in the subjective aural axis there must be, for each point on one side of the axis, a point on the opposite side of the axis with similar characteristics. That is, a sound near the subjective aural axis permits of more than one interpretation in terms of perception, and hence a system of confusion points.

In recent years, the so-called secondary, qualitative factors have been recognized as important elements of localization. Intensity was held as a very essential factor but recent investigations[1] show that we are not justified in laying so much emphasis upon it. Intensity alone is not sufficient to account for all the features of localization. The fact that monaural localization has been demonstrated indicates a more complicated basis for the perceiving of direction of sounds. Careful observation and introspection point to the presence and importance of qualitative data in the process of localization.

Referring again to the curve of Bloch, we find that it does not indicate any prominences or deflections beyond the general fact of poorer discrimination at the side. The chief reason for this is that the standards which he tested are farther apart,

namely 22.5°. In the charts, with standards 15° apart, the prominences do not appear so regularly as in Fig. 3, with standards, 5° apart.

---

[1] Angell and Fite, 'Monaural Localization of Sound,' PSYCH. REV., 1901, VIII., pp. 225–246; pp. 449–458.

Angell, 'Significance of Partial Tones,' PSYCH. REV., 1903, X., pp. 1–14. Pierce, *Studies in Space Perception.*

SERIES II. VERTICAL PLANES.

The immediate aim of this series is to determine the power of discrimination between directions of sounds in vertical planes.

The apparatus and its arrangements are exactly the same as in the first series with one exception. It was possible in the first series to procure uniformity in the reflection of sounds by keeping the source of the sound in the same locality and allowing the observer to take different positions for the various standards. This could not be done in the vertical measurements. To overcome this difficulty a screen was devised consisting of a frame built of iron pipes over which a canvass was stretched. The screen thus constructed had the shape of a hollow cylinder 3.40 meters in diameter and 2.70 meters in length. It was so situated with reference to the perimeter that the center of the

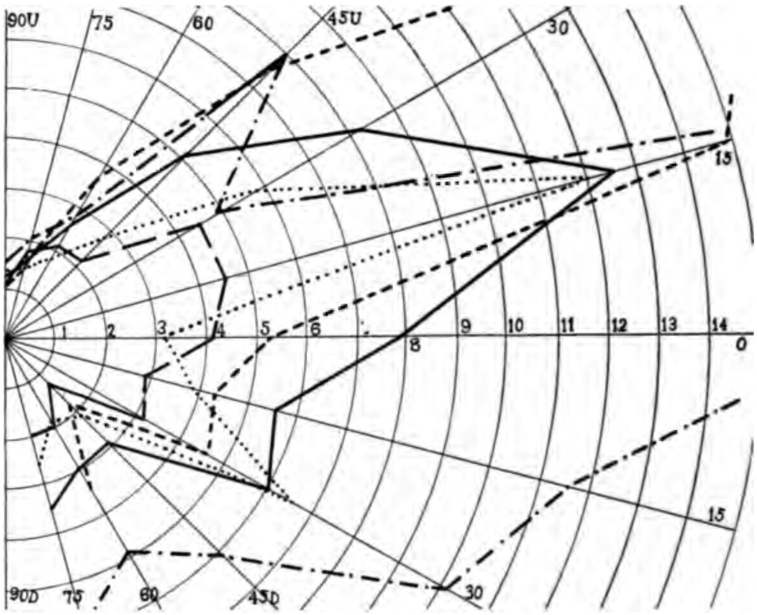


FIG. 13. Vertical plane 90°r.

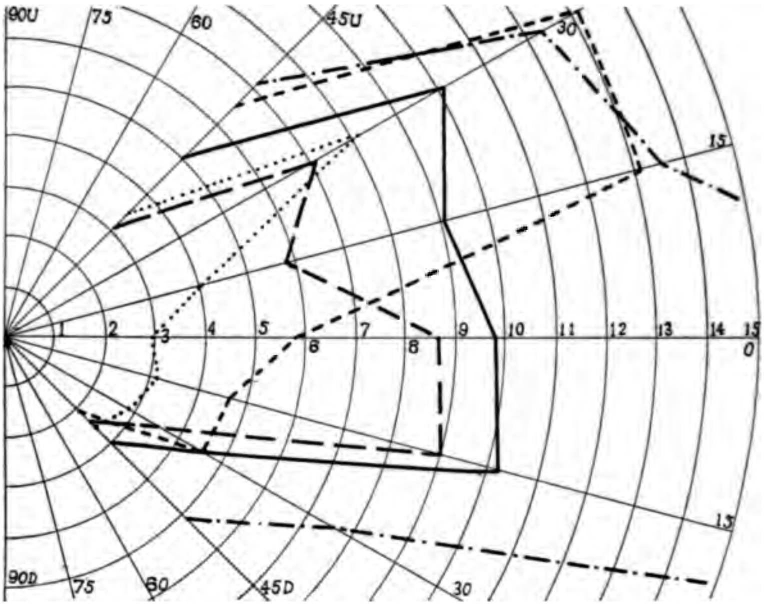


FIG. 14. Vertical plane 75°rf.

sphere described by the arms of the perimeter coincided with the center of the cylindrical screen.

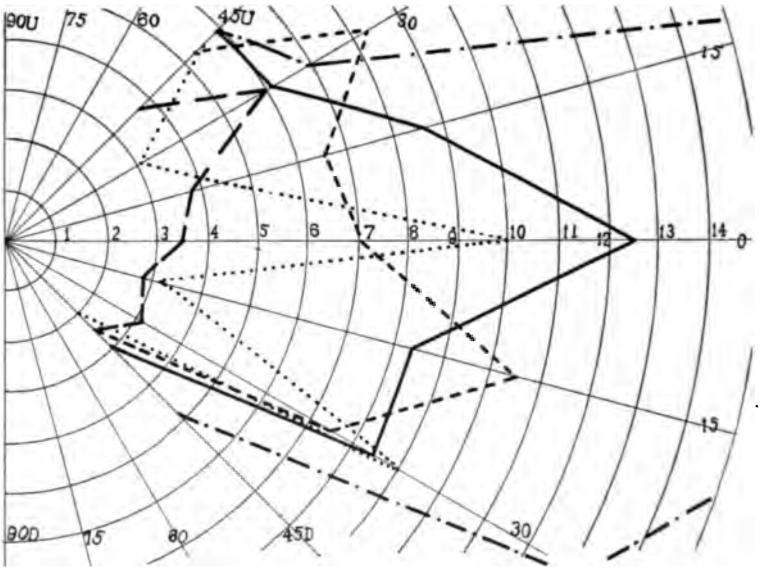


FIG. 15. Vertical plane 75°rb.

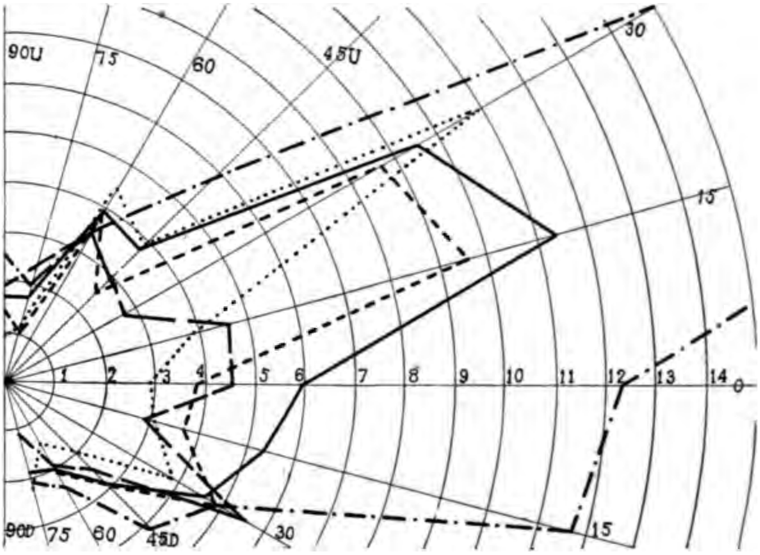


FIG. 16. Vertical plane 60°rf.

A brief but careful test was made of one of the vertical planes to discover whether the screen would be sufficient to give uniform reflection. The observer took a horizontal position on

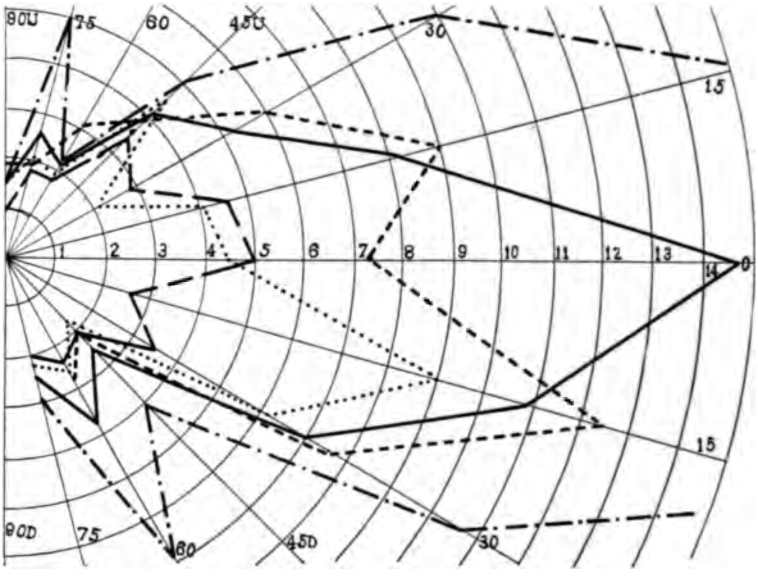


FIG. 17. Vertical plane 60°rb.

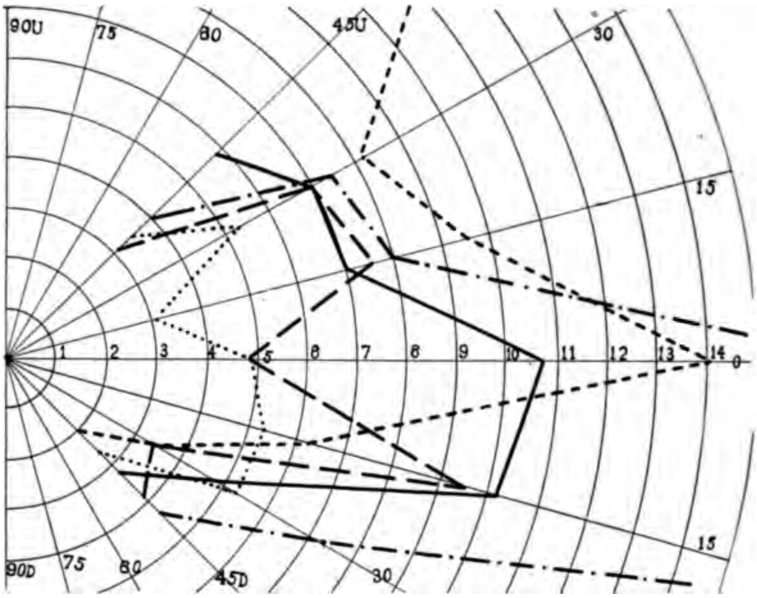


FIG. 18. Vertical plane 45°rf.

a bench constructed with as little material as possible. The stimuli were given in the same manner and locality as in Series I. The results indicated no essential deviation from those

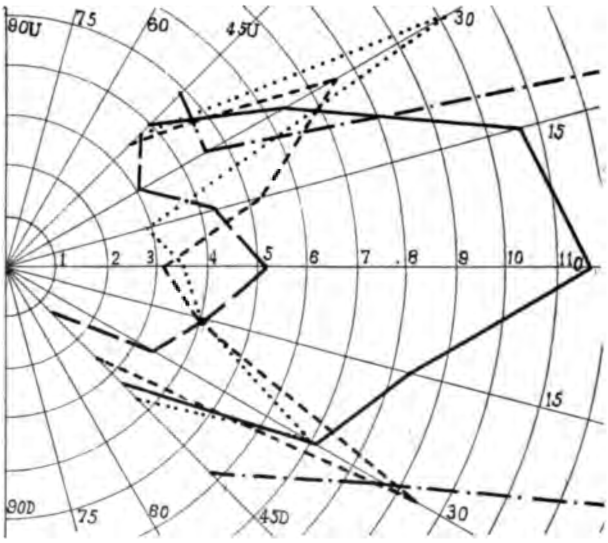


FIG. 19. Vertical plane 45°rb.

obtained when the screen was used and the observers had the upright position.

The standards, one hundred and twenty-five in number, are in the following vertical planes (see Fig. 2): 90°r, 75°rf, 75°rb, 60°rf, 60°rb, 45°rf, 45°rb, 30°rf, 30°rb, 15°rf, 15°rb, and the median plane. The planes 90°r, 60°rf, 60°rb, 30°rf, 30°rb, have twelve standards each, 15° apart. The point 90° down was not tested. The planes 75°rf, 75°rb, 45°rf, 45°rb, 15°rf, and 15°rb, have seven standards each, 15° apart and ranging

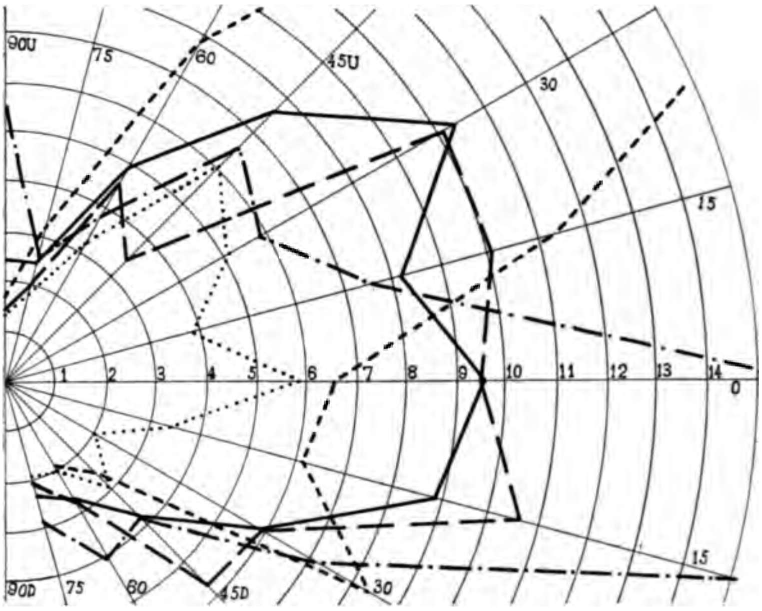


FIG. 20. Vertical plane 30°rf.

from 45°u to 45°d. In the median plane are twenty-three standards.

Each of the four regular observers, *W*, *K*, *B*, and *S*, gave fifty judgments at each standard passing through the entire series of points in the double fatigue order, which gives in all about 25,000 judgments.

The charts are constructed on the same principle as in the foregoing series but here a degree has the same distance-value throughout, namely, 17.5 mm.

be binaural and becomes monaural.[1] The localization of sounds coming from the front or near the front depends, in individuals having both ears normal, upon the coördinating function of the two ears. But sounds here at the side are not distinguished from one another by this combined action alone. The left ear drops out of service and the right ear becomes the chief means of perceiving the sounds. Those from the right side do not, in the nature of the case, reach the left ear as directly as from points in or near the median plane. It cannot be otherwise than that a sound on the side is stronger to the ear on that side. Frequently the observers remarked in passing from one standard to another in the locality of this transition, as for example at 45°rf or 60°rf, that there the sounds were very strongly perceptible to the right ear. The more favorably an ear can receive a sound the more responsible that ear is for a correct localization. Qualitative and quantitative features are among the determining elements or local signs of direction.

The modifying effect of the pinna and side of the head become influential. The function of the former is twofold, positive and negative: positive in aiding the passage of sound waves to the meatus, negative in obstructing the course of sound waves. The more favorably a sound is situated to reach the meatus the more forcible, complete and full will it be. This fact was well illustrated by the pseudophone of S. P. Thompson.[2] His conclusion is that the 'intensity of a perceived sound depends upon the amount of space over which the waves are gathered by the external collecting apparatus of the ear; and by analogy with optical phenomena we may say it depends upon the number of rays of sound which reach the ear.'

As we pass the aural axis the sounds farther forward, instead of backward as before, seem louder and more distinct. Hence there is a third transition point at the subjective aural axis. In the rear quadrant sounds seem most distant about the middle of the quadrant and, corresponding to the two transition points in the front quadrant, there are two in the rear quadrant since the conditions of localization are practically the same at ob as at of.

---

[1] The terms binaural and monaural are not used in their ordinary absolute meaning.

[2] Thompson, 'The Pseudophone.' *Phil. Mag.*, VIII., 1879, pp. 385-390.

In all there are five transition points (T). The first T1, lies between 0°f and 45°rf, the second, T1′, is located symmetrically in the rear quadrant, the third, T2, and the fourth, T2′, are near or just beyond the middle of the quadrants, and the fifth, T3, is at the aural axis. T1 is essentially a change in binaural localization 'from the condition in which sounds compared are seemingly at the same distance and of the same intensity to the condition in which the sound at the right of the standard appears more distant.' T2 is essentially a transition from binaural to monaural localization. T3 is a change in monaural localization, *i. e.*, a reversal of the monaural process. More will be said below in regard to this transition point. T2′ and T1′ are reversals of T2 and T1 respectively.

The positions of the transition points correspond to the positions of the prominences in the curves. T1 corresponds to P1, T1′ to P1′, T2 to P2, T2′ to P2′, and T3 to P3. Now, the relation between the two is in the fact that change in the data and elementary processes involved in localization, *i.e.*, change in the basis of discrimination must cause more or less confusion on the part of the observer. In several of the introspections the observation is made that at some standards it was especially difficult to localize. It may be noticed that these directions correspond to the positions of the prominences. That these transitions resulted in confusion is further supported by the introspective remark of the observers that a definite distinction could be noticed between the standard and the sound compared with it but that the observer could not tell with certainty on which side of the standard the second sound was. Consequently more errors were made, and hence the prominences in the curves. But in a large number of trials the observer soon learned to interpret these distinctions correctly, in part at least. In other words he became adapted to the modified method. That such adaptation actually occurred is quite apparent from the distribution of the errors in the records. In 75 per cent. of all such transitions the records show that nearly all errors made at a standard were made in the first half of all the trials made with that standard. This clearly indicates that in the second half the observer had learned to interpret more correctly the

distinctions that were already recognized in the first half but not understood.

In regard to P3 it should be mentioned that beside the fact that it is a transition, there is another condition involved. There must be a point in the aural axis or thereabouts where the coördinating function of the two ears reaches its minimum, or where monaural localization reaches its maximum. If the two ears render any assistance to each other in the perception of direction there must be a point where this mutual effect is least, and consequently tends to make discrimination less accurate. Then there is also the presence of confusion points. A telephone moving from front toward back comes to a position in or near the aural axis where it has its greatest monaural intensity. The locus of this point at different distances from the head was above designated as the subjective aural axis. If the monaural intensity is maximal in the subjective aural axis there must be, for each point on one side of the axis, a point on the opposite side of the axis with similar characteristics. That is, a sound near the subjective aural axis permits of more than one interpretation in terms of perception, and hence a system of confusion points.

In recent years, the so-called secondary, qualitative factors have been recognized as important elements of localization. Intensity was held as a very essential factor but recent investigations[1] show that we are not justified in laying so much emphasis upon it. Intensity alone is not sufficient to account for all the features of localization. The fact that monaural localization has been demonstrated indicates a more complicated basis for the perceiving of direction of sounds. Careful observation and introspection point to the presence and importance of qualitative data in the process of localization.

Referring again to the curve of Bloch, we find that it does not indicate any prominences or deflections beyond the general fact of poorer discrimination at the side. The chief reason for this is that the standards which he tested are farther apart,

[1] Angell and Fite, 'Monaural Localization of Sound,' PSYCH. REV., 1901, VIII., pp. 225–246; pp. 449–458.

Angell, 'Significance of Partial Tones,' PSYCH. REV., 1903, X., pp. 1–14. Pierce, *Studies in Space Perception.*

namely 22.5°. In the charts, with standards 15° apart, the prominences do not appear so regularly as in Fig. 3, with standards, 5° apart.

SERIES II. VERTICAL PLANES.

The immediate aim of this series is to determine the power of discrimination between directions of sounds in vertical planes.

The apparatus and its arrangements are exactly the same as in the first series with one exception. It was possible in the first series to procure uniformity in the reflection of sounds by keeping the source of the sound in the same locality and allowing the observer to take different positions for the various standards. This could not be done in the vertical measurements. To overcome this difficulty a screen was devised consisting of a frame built of iron pipes over which a canvass was stretched. The screen thus constructed had the shape of a hollow cylinder 3.40 meters in diameter and 2.70 meters in length. It was so situated with reference to the perimeter that the center of the

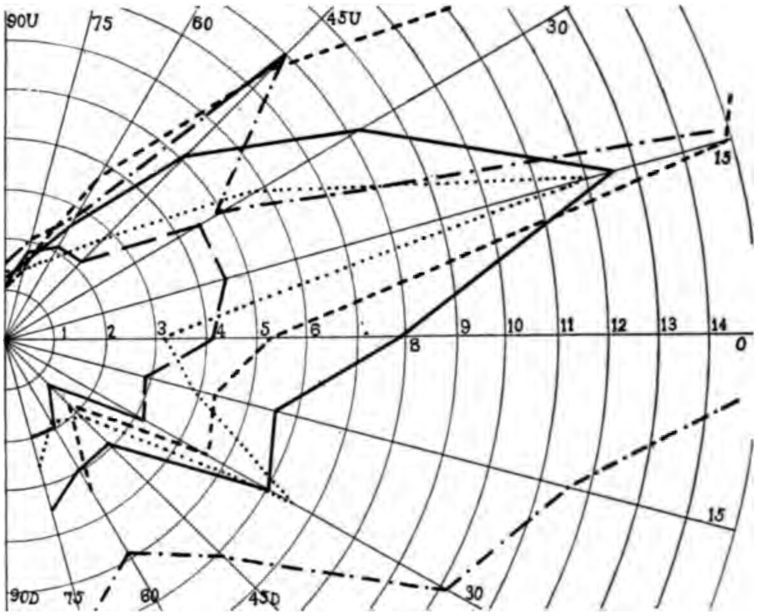


FIG. 13. Vertical plane 90°r.

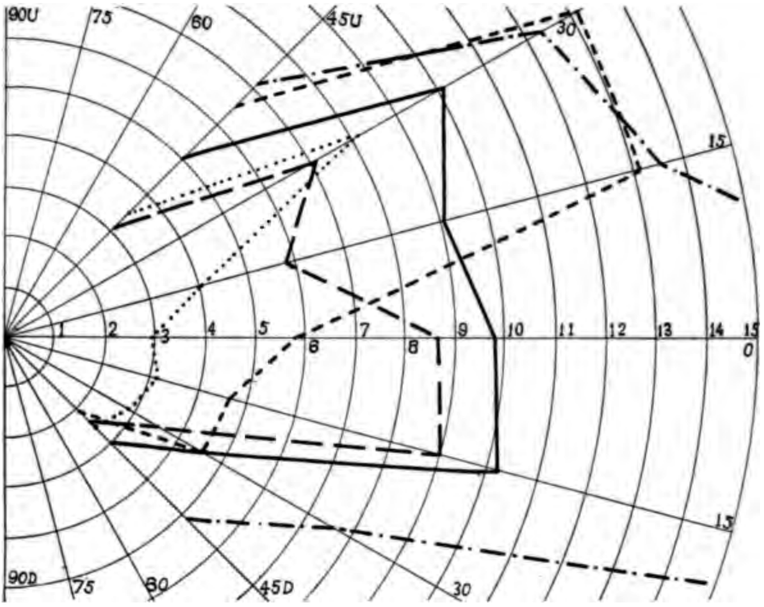


FIG. 14. Vertical plane 75°rf.

sphere described by the arms of the perimeter coincided with the center of the cylindrical screen.

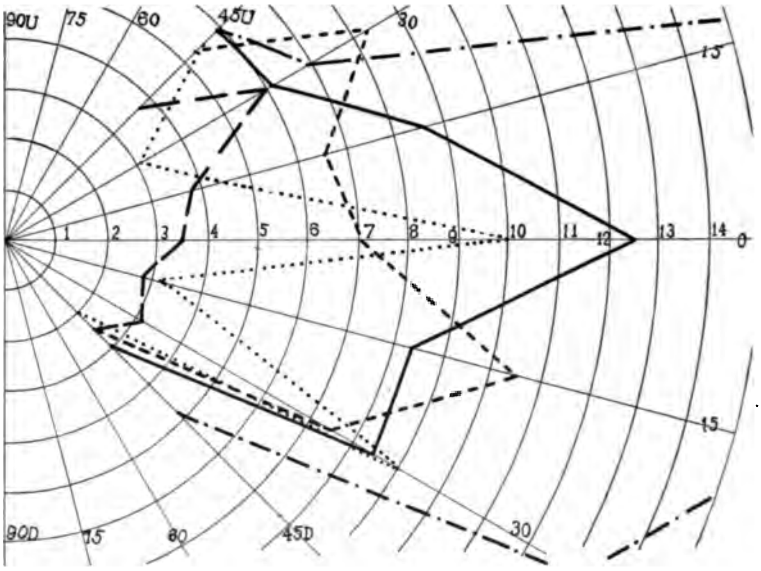


FIG. 15. Vertical plane 75°rb.

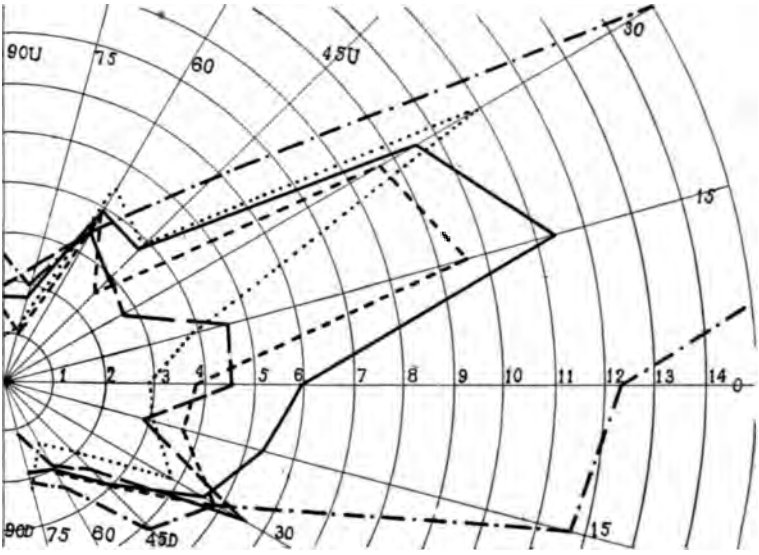


FIG. 16. Vertical plane 60°rf.

A brief but careful test was made of one of the vertical planes to discover whether the screen would be sufficient to give uniform reflection. The observer took a horizontal position on

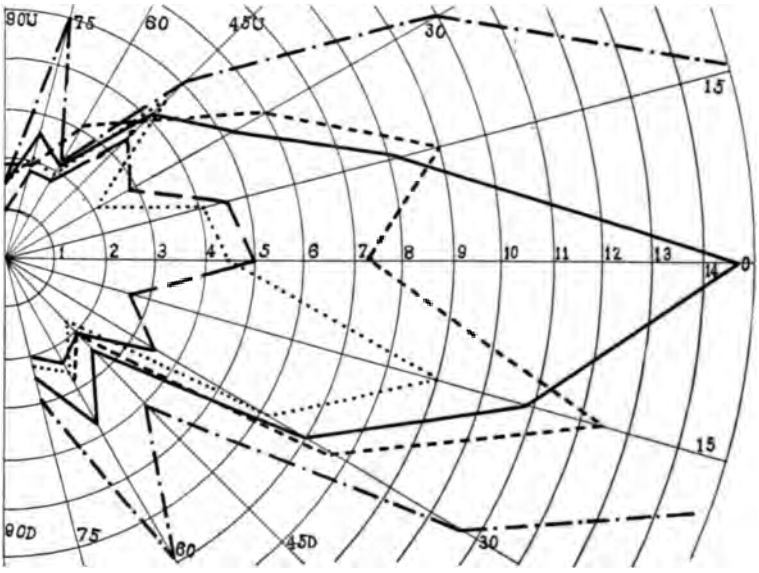


FIG. 17. Vertical plane 60°rb.

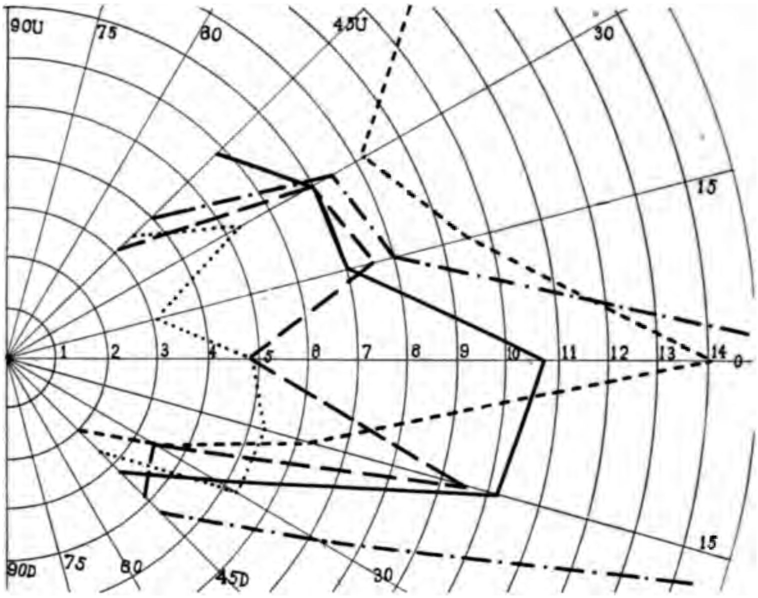


FIG. 18. **Vertical plane 45°rf.**

a bench constructed with as little material as possible. The stimuli were given in the same manner and locality as in Series I. The results indicated no essential deviation from those

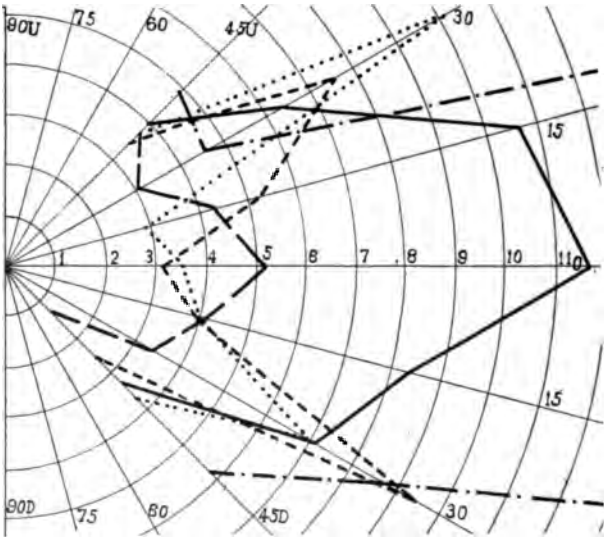


FIG. 19. **Vertical plane 45°rb.**

obtained when the screen was used and the observers had the upright position.

The standards, one hundred and twenty-five in number, are in the following vertical planes (see Fig. 2): 90°r, 75°rf, 75°rb, 60°rf, 60°rb, 45°rf, 45°rb, 30°rf, 30°rb, 15°rf, 15°rb, and the median plane. The planes 90°r, 60°rf, 60°rb, 30°rf, 30°rb, have twelve standards each, 15° apart. The point 90° down was not tested. The planes 75°rf, 75°rb, 45°rf, 45°rb, 15°rf, and 15°rb, have seven standards each, 15° apart and ranging from 45°u to 45°d. In the median plane are twenty-three standards.

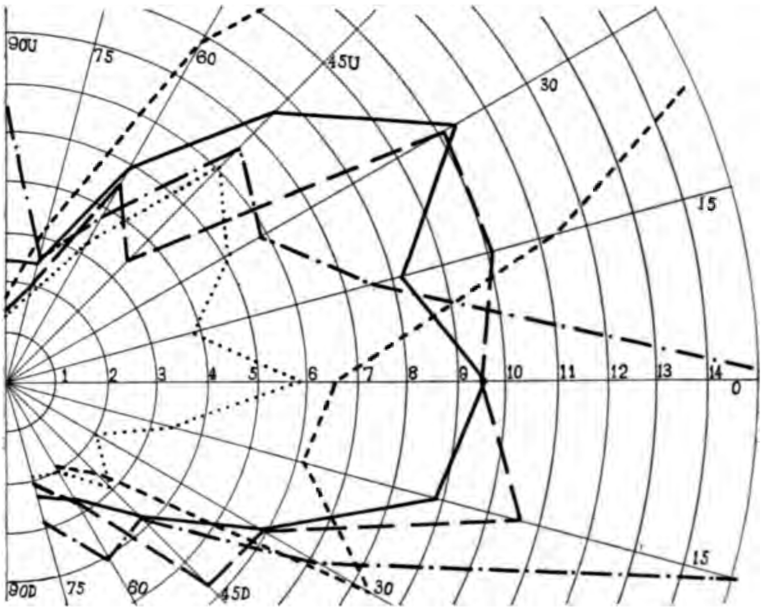


FIG. 20. Vertical plane 30°rf.

Each of the four regular observers, *W*, *K*, *B*, and *S*, gave fifty judgments at each standard passing through the entire series of points in the double fatigue order, which gives in all about 25,000 judgments.

The charts are constructed on the same principle as in the foregoing series but here a degree has the same distance-value throughout, namely, 17.5 mm.

be binaural and becomes monaural.[1] The localization of sounds coming from the front or near the front depends, in individuals having both ears normal, upon the coördinating function of the two ears. But sounds here at the side are not distinguished from one another by this combined action alone. The left ear drops out of service and the right ear becomes the chief means of perceiving the sounds. Those from the right side do not, in the nature of the case, reach the left ear as directly as from points in or near the median plane. It cannot be otherwise than that a sound on the side is stronger to the ear on that side. Frequently the observers remarked in passing from one standard to another in the locality of this transition, as for example at 45°rf or 60°rf, that there the sounds were very strongly perceptible to the right ear. The more favorably an ear can receive a sound the more responsible that ear is for a correct localization. Qualitative and quantitative features are among the determining elements or local signs of direction.

The modifying effect of the pinna and side of the head become influential. The function of the former is twofold, positive and negative: positive in aiding the passage of sound waves to the meatus, negative in obstructing the course of sound waves. The more favorably a sound is situated to reach the meatus the more forcible, complete and full will it be. This fact was well illustrated by the pseudophone of S. P. Thompson.[2] His conclusion is that the 'intensity of a perceived sound depends upon the amount of space over which the waves are gathered by the external collecting apparatus of the ear; and by analogy with optical phenomena we may say it depends upon the number of rays of sound which reach the ear.'

As we pass the aural axis the sounds farther forward, instead of backward as before, seem louder and more distinct. Hence there is a third transition point at the subjective aural axis. In the rear quadrant sounds seem most distant about the middle of the quadrant and, corresponding to the two transition points in the front quadrant, there are two in the rear quadrant since the conditions of localization are practically the same at ob as at of.

[1] The terms binaural and monaural are not used in their ordinary absolute meaning.

[2] Thompson, 'The Pseudophone.' *Phil. Mag.*, VIII., 1879, pp. 385–390.

In all there are five transition points (T). The first T1, lies between 0°f and 45°rf, the second, T1′, is located symmetrically in the rear quadrant, the third, T2, and the fourth, T2′, are near or just beyond the middle of the quadrants, and the fifth, T3, is at the aural axis. T1 is essentially a change in binaural localization 'from the condition in which sounds compared are seemingly at the same distance and of the same intensity to the condition in which the sound at the right of the standard appears more distant.' T2 is essentially a transition from binaural to monaural localization. T3 is a change in monaural localization, *i. e.*, a reversal of the monaural process. More will be said below in regard to this transition point. T2′ and T1′ are reversals of T2 and T1 respectively.

The positions of the transition points correspond to the positions of the prominences in the curves. T1 corresponds to P1, T1′ to P1′, T2 to P2, T2′ to P2′, and T3 to P3. Now, the relation between the two is in the fact that change in the data and elementary processes involved in localization, *i.e.*, change in the basis of discrimination must cause more or less confusion on the part of the observer. In several of the introspections the observation is made that at some standards it was especially difficult to localize. It may be noticed that these directions correspond to the positions of the prominences. That these transitions resulted in confusion is further supported by the introspective remark of the observers that a definite distinction could be noticed between the standard and the sound compared with it but that the observer could not tell with certainty on which side of the standard the second sound was. Consequently more errors were made, and hence the prominences in the curves. But in a large number of trials the observer soon learned to interpret these distinctions correctly, in part at least. In other words he became adapted to the modified method. That such adaptation actually occurred is quite apparent from the distribution of the errors in the records. In 75 per cent. of all such transitions the records show that nearly all errors made at a standard were made in the first half of all the trials made with that standard. This clearly indicates that in the second half the observer had learned to interpret more correctly the

distinctions that were already recognized in the first half but not understood.

In regard to P3 it should be mentioned that beside the fact that it is a transition, there is another condition involved. There must be a point in the aural axis or thereabouts where the coördinating function of the two ears reaches its minimum, or where monaural localization reaches its maximum. If the two ears render any assistance to each other in the perception of direction there must be a point where this mutual effect is least, and consequently tends to make discrimination less accurate. Then there is also the presence of confusion points. A telephone moving from front toward back comes to a position in or near the aural axis where it has its greatest monaural intensity. The locus of this point at different distances from the head was above designated as the subjective aural axis. If the monaural intensity is maximal in the subjective aural axis there must be, for each point on one side of the axis, a point on the opposite side of the axis with similar characteristics. That is, a sound near the subjective aural axis permits of more than one interpretation in terms of perception, and hence a system of confusion points.

In recent years, the so-called secondary, qualitative factors have been recognized as important elements of localization. Intensity was held as a very essential factor but recent investigations[1] show that we are not justified in laying so much emphasis upon it. Intensity alone is not sufficient to account for all the features of localization. The fact that monaural localization has been demonstrated indicates a more complicated basis for the perceiving of direction of sounds. Careful observation and introspection point to the presence and importance of qualitative data in the process of localization.

Referring again to the curve of Bloch, we find that it does not indicate any prominences or deflections beyond the general fact of poorer discrimination at the side. The chief reason for this is that the standards which he tested are farther apart,

namely 22.5°. In the charts, with standards 15° apart, the prominences do not appear so regularly as in Fig. 3, with standards, 5° apart.

---

[1] Angell and Fite, 'Monaural Localization of Sound,' PSYCH. REV., 1901, VIII., pp. 225–246; pp. 449–458.

Angell, 'Significance of Partial Tones,' PSYCH. REV., 1903, X., pp. 1–14. Pierce, *Studies in Space Perception*.

SERIES II. VERTICAL PLANES.

The immediate aim of this series is to determine the power of discrimination between directions of sounds in vertical planes.

The apparatus and its arrangements are exactly the same as in the first series with one exception. It was possible in the first series to procure uniformity in the reflection of sounds by keeping the source of the sound in the same locality and allowing the observer to take different positions for the various standards. This could not be done in the vertical measurements. To overcome this difficulty a screen was devised consisting of a frame built of iron pipes over which a canvass was stretched. The screen thus constructed had the shape of a hollow cylinder 3.40 meters in diameter and 2.70 meters in length. It was so situated with reference to the perimeter that the center of the

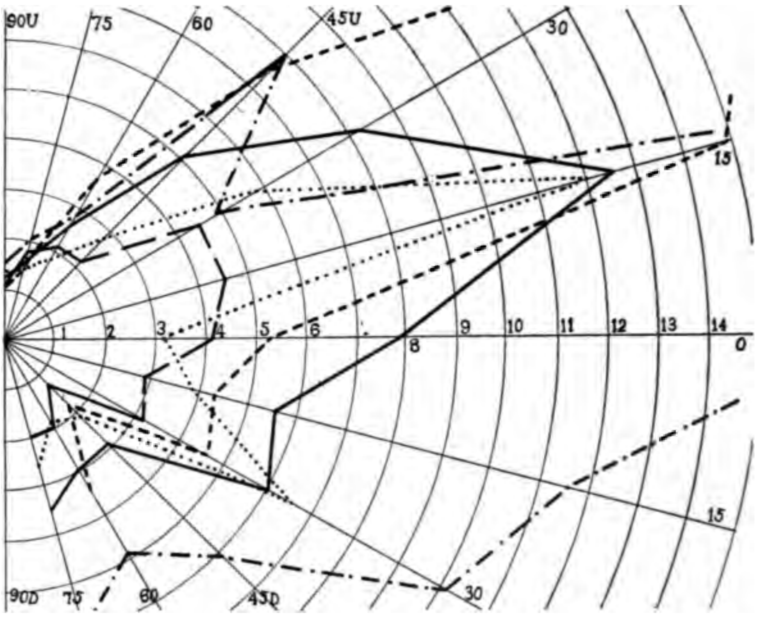


FIG. 13. Vertical plane 90°r.

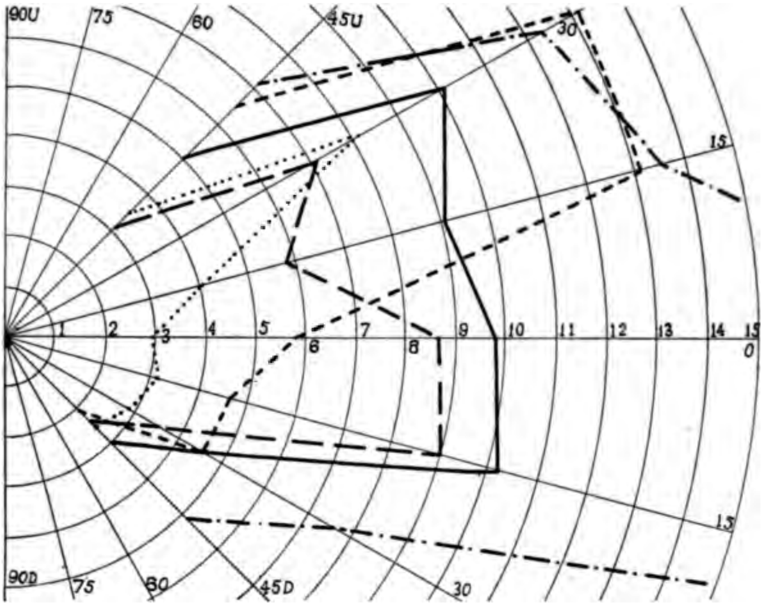


FIG. 14. Vertical plane 75°rf.

sphere described by the arms of the perimeter coincided with the center of the cylindrical screen.

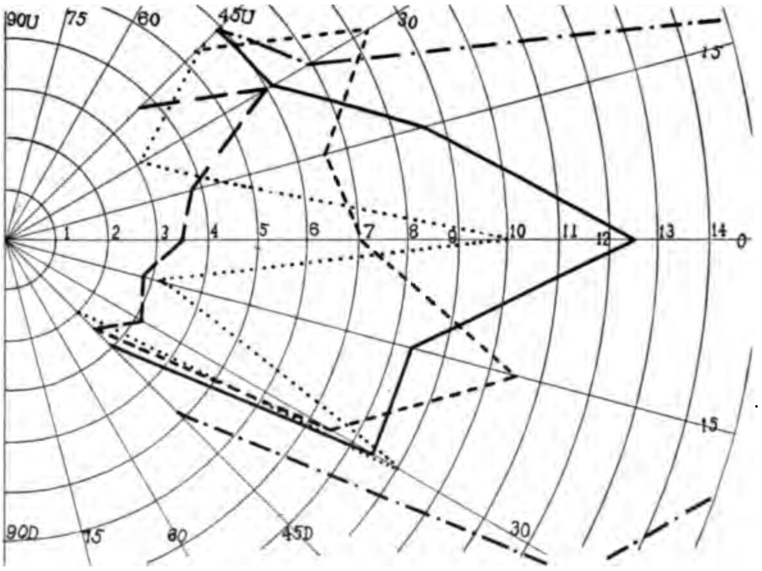


FIG. 15. Vertical plane 75°rb.

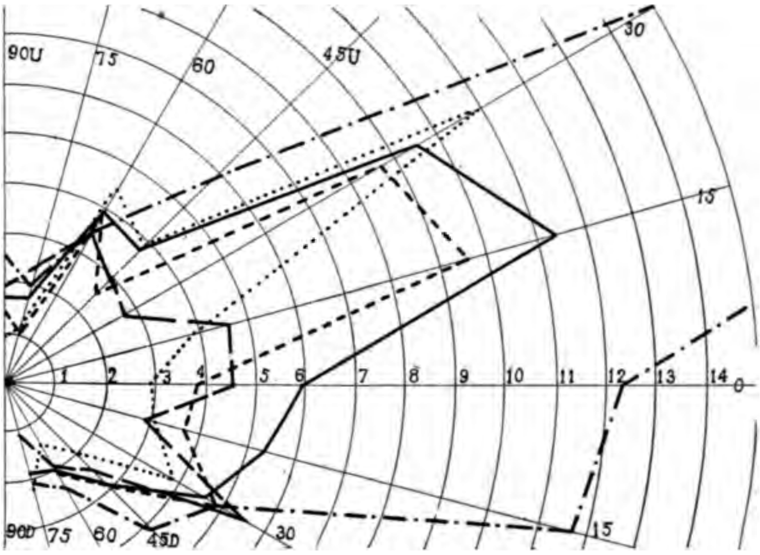


FIG. 16. Vertical plane 60°rf.

A brief but careful test was made of one of the vertical planes to discover whether the screen would be sufficient to give uniform reflection. The observer took a horizontal position on

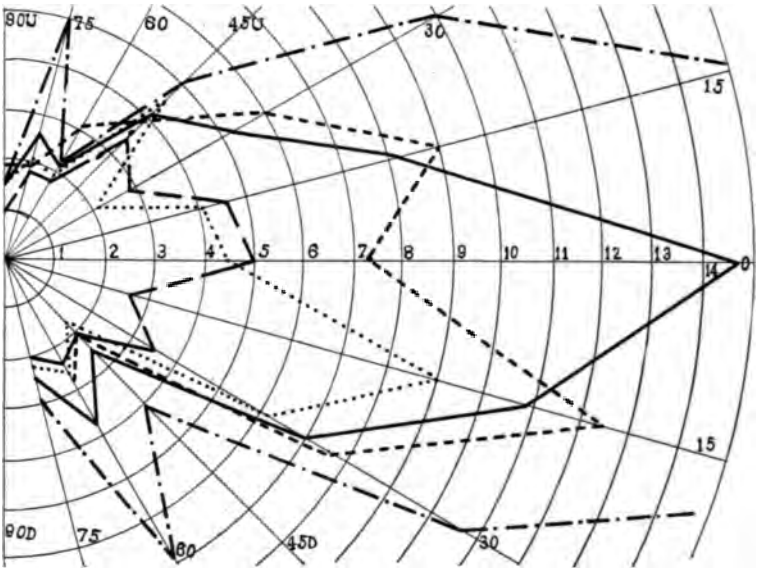


FIG. 17. Vertical plane 60°rb.

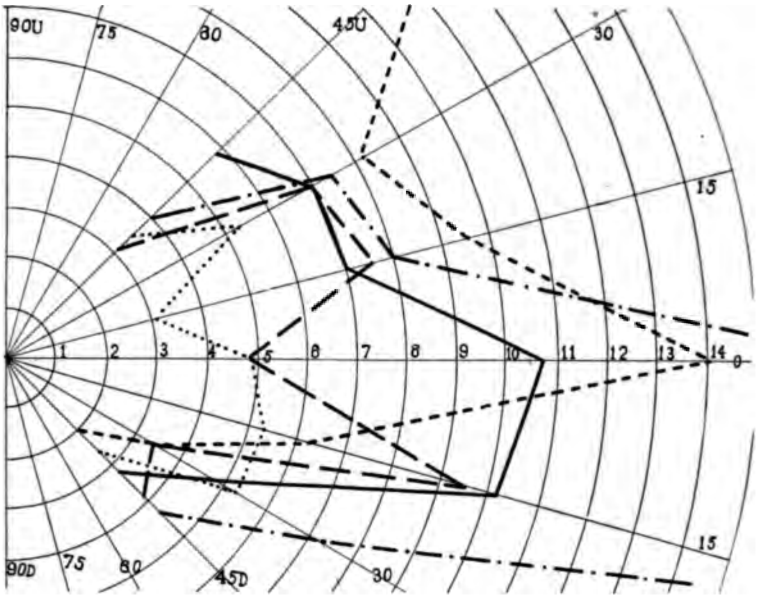


Fig. 18. Vertical plane 45°rf.

a bench constructed with as little material as possible. The stimuli were given in the same manner and locality as in Series I. The results indicated no essential deviation from those

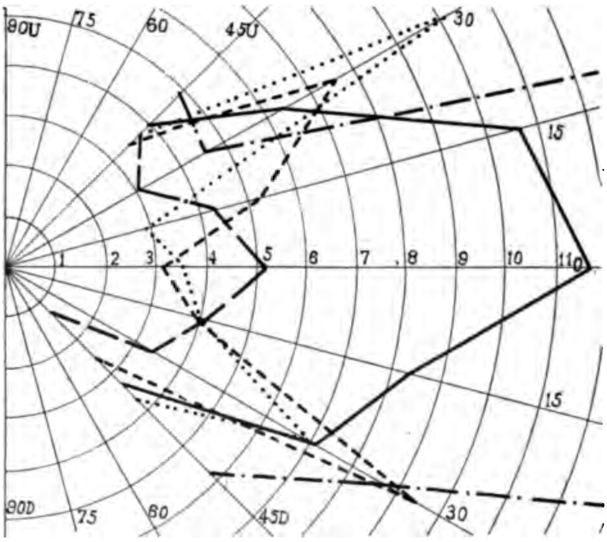


Fig. 19. Vertical plane 45°rb.

obtained when the screen was used and the observers had the upright position.

The standards, one hundred and twenty-five in number, are in the following vertical planes (see Fig. 2): 90°r, 75°rf, 75°rb, 60°rf, 60°rb, 45°rf, 45°rb, 30°rf, 30°rb, 15°rf, 15°rb, and the median plane. The planes 90°r, 60°rf, 60°rb, 30°rf, 30°rb, have twelve standards each, 15° apart. The point 90° down was not tested. The planes 75°rf, 75°rb, 45°rf, 45°rb, 15°rf, and 15°rb, have seven standards each, 15° apart and ranging

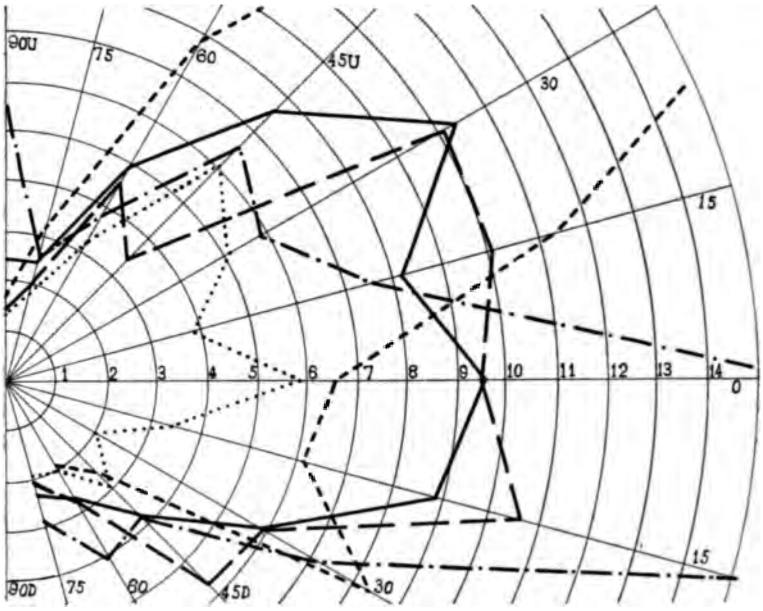


FIG. 20. Vertical plane 30°rf.

from 45°u to 45°d. In the median plane are twenty-three standards.

Each of the four regular observers, *W*, *K*, *B*, and *S*, gave fifty judgments at each standard passing through the entire series of points in the double fatigue order, which gives in all about 25,000 judgments.

The charts are constructed on the same principle as in the foregoing series but here a degree has the same distance-value throughout, namely, 17.5 mm.

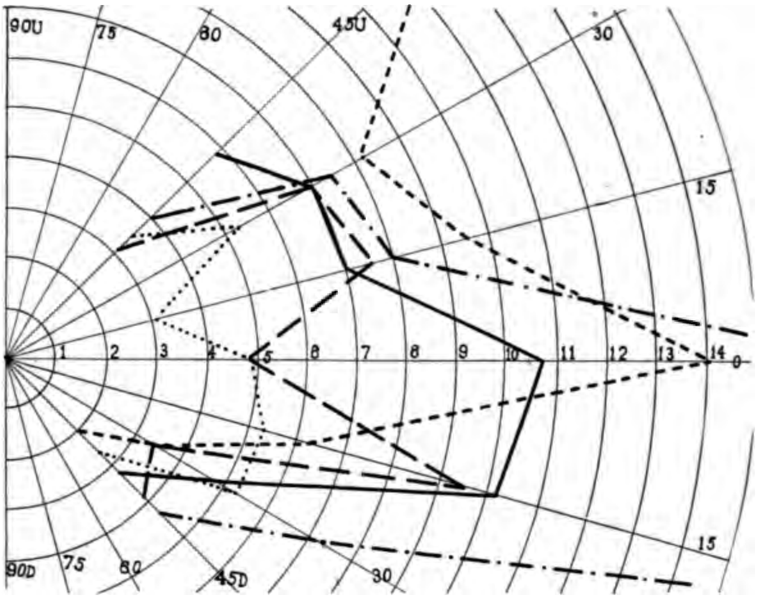


FIG. 18. Vertical plane 45°rf.

a bench constructed with as little material as possible. The stimuli were given in the same manner and locality as in Series I. The results indicated no essential deviation from those

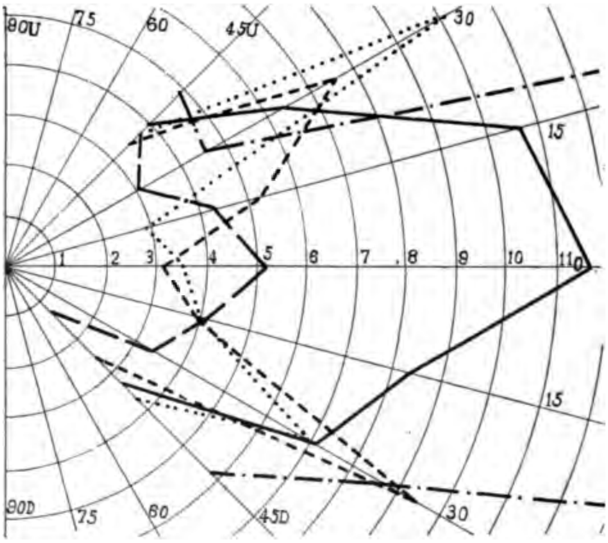


FIG. 19. Vertical plane 45°rb.

obtained when the screen was used and the observers had the upright position.

The standards, one hundred and twenty-five in number, are in the following vertical planes (see Fig. 2): 90°r, 75°rf, 75°rb, 60°rf, 60°rb, 45°rf, 45°rb, 30°rf, 30°rb, 15°rf, 15°rb, and the median plane. The planes 90°r, 60°rf, 60°rb, 30°rf, 30°rb, have twelve standards each, 15° apart. The point 90° down was not tested. The planes 75°rf, 75°rb, 45°rf, 45°rb, 15°rf, and 15°rb, have seven standards each, 15° apart and ranging from 45°u to 45°d. In the median plane are twenty-three standards.

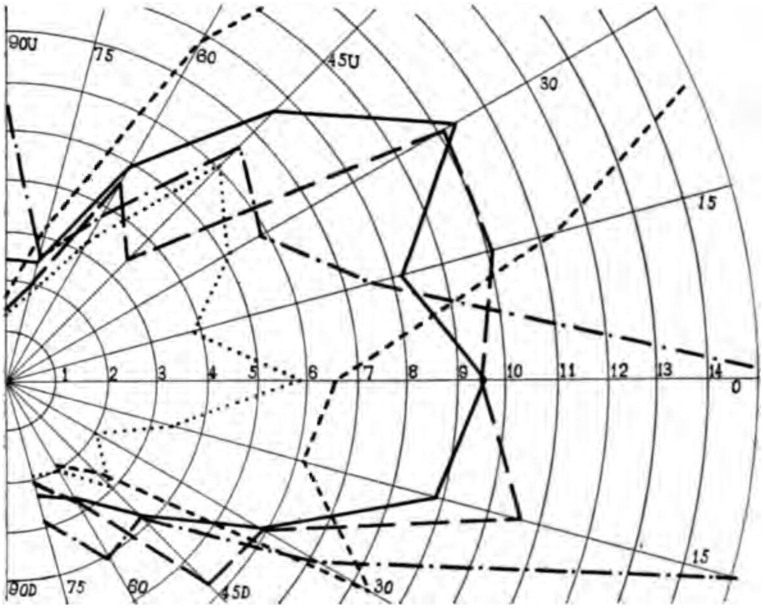


FIG. 20. Vertical plane 30°rf.

Each of the four regular observers, *W*, *K*, *B*, and *S*, gave fifty judgments at each standard passing through the entire series of points in the double fatigue order, which gives in all about 25,000 judgments.

The charts are constructed on the same principle as in the foregoing series but here a degree has the same distance-value throughout, namely, 17.5 mm.

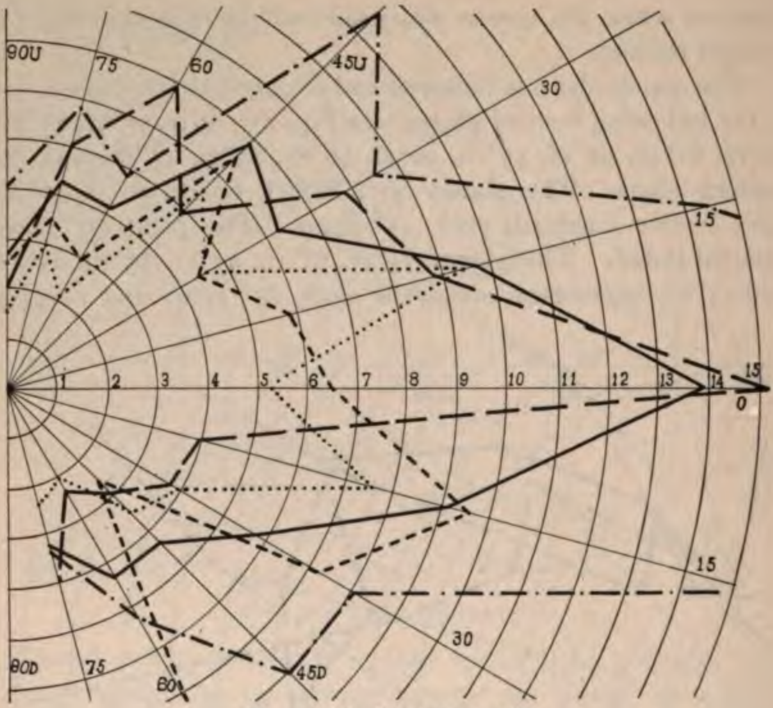


FIG. 21. Vertical plane 30°rb.

A. THE VERTICAL PLANES EXCLUDING THE MEDIAN PLANE.

Data in the Curves.

(*a*) Localization is most delicate at the point directly overhead. (*b*) There is an approach toward considerable accuracy in the lower quadrant near the median plane. (*c*) In addition to the fact that localization is less accurate at the side there are several conspicuous prominences situated similarly to those in the curves of the first series. Particularly illustrative of this are Figs. 13, 16, and 17.

Discussion: Introspective and Theoretical.

Localization in the Median Plane Belt. — The keenness in discrimination at the two positions above and below accords with what has been said before in regard to the localization in the belt along the median plane. The two directions are simply particular cases of that general rule. The results also agree

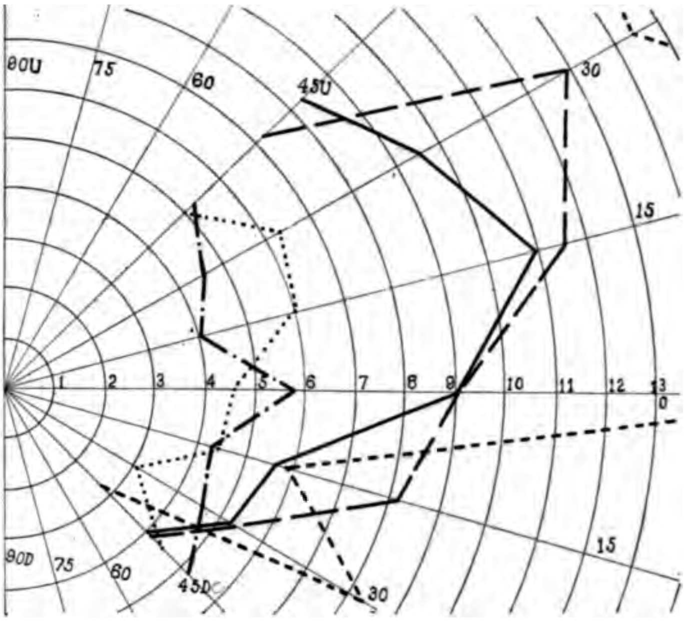


FIG. 22. Vertical plane 15°rf.

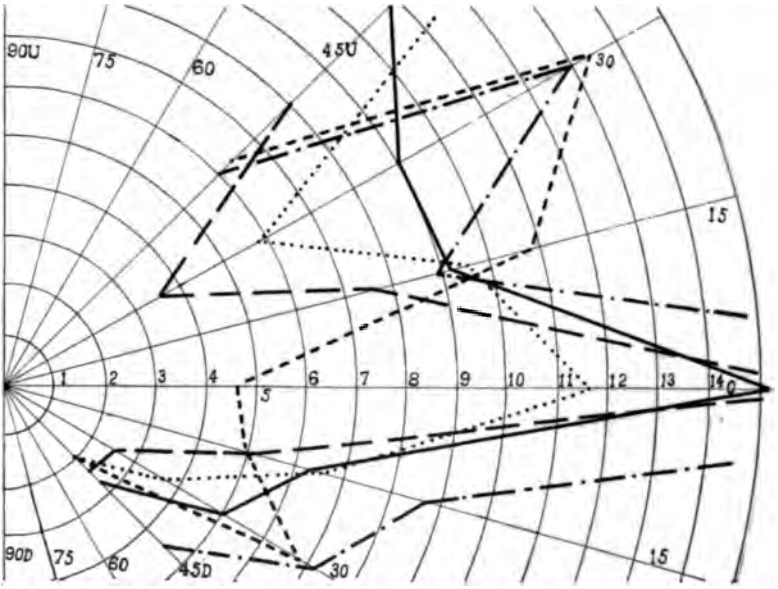


FIG. 23. Vertical plane 15°rb.

with the experiments of Bloch[1] who made some measurements in the vertical plane 90°r and found that his observer showed quite accurate discrimination in these two directions.

Localization at the side. 1. Introspective.—The following illustrations are quoted from the records.

Standard 45°u. "Here the difference is very distinct. Those up seem as if there were some intervening object between the source of the sound and the ear, while those down come directly to the ear. It seems as if the upper edge of the pinna were a dividing line between the ups and the downs, the former being back of the pinna and the latter in the direct field of the pinna."

Standard 30°u. "The ups are higher in pitch."

Standard 0°. "The ups and the downs seem to be alike. It is confusing."

Standard 30°d. "The ups seem nearer and the downs seem down and farther away and strike the face differently."

These introspections indicate that localization is more difficult in some directions than in others, and that there are noticeable variations in intensity, distance, distinctness, pitch, etc.

For the purpose of determining more definitely the distinguishing features or local signs of direction, a special set of tests was made upon three other observers, *C*, *G*, and *Sc*. These observers had no special knowledge of the localization of sound and knew nothing of the results hitherto obtained. The three typical standards 45°u, 0°, and 45°d in each of the three vertical planes 45°rf, 90°r, and 45°rb were used as the localities of the experiment. The method of procedure was entirely the same as in the regular experiments except that the distance-interval was large enough to make the distinctions easily perceptible. This required interval was found in each case by a few preliminary trials. Ten trials were made with each standard by each observer. Before beginning the test the observer was told to describe as accurately and precisely as he could the differences that he noticed between the sounds from the directions under comparison. The results are given in tables V, VI, VII.

These figures scarcely need a word of comment.

(*a*) Intensity is the most effective datum. In Table V. under *up*, seventeen are said to be fainter and two louder; under *down*, nine are louder. In Table VI. under *down*, twelve are fainter and one louder; under *up*, seventeen are

---

[1] Bloch, *loc. cit.*, p. 39.

TABLE V.

THE STANDARD 45° UP IN EACH OF THE THREE PLANES.

Observers.	Planes.	Up.							Down.						
		Fainter.	Further.	Less Clear.	Pitch.		Thinner.	Displacement.	Louder.	Nearer.	Clearer.	Pitch.		Richer.	Displacement.
					h.	l.						h.	l.		
C	45°rf	1(1)	2		2	2		3f	1	1			1		1b
	90°r	3	2	2			1	1f	1	5			3	1	
	45°rb				1			3b	1	1			3	1(1)	1f
G	45°rf	2		2				4f	1		3		1 (?)		5b
	90°r	3(1)	1					2f	4	3					4b
	45°rb	3	2						1	3	4				
Sc	45°rf	1			1	2				1		1	3		4f
	90°r	4	1		3	1						1	1		5b
	45°rb		1(1)		3	2				1		2	3		
		17(2)	9(1)	4	10	7	1		9	15	7	4	15	2(1)	

The figures in parenthesis are the numbers of judgment of the opposite sort to those in the column under which they occur.

TABLE VI.

STANDARDS 45° DOWN IN EACH OF THE THREE PLANES.

Observers.	Planes.	Down.							Up.						
		Fainter.	Further.	Less Clear.	Pitch.		Thinner.	Displacement.	Louder.	Nearer.	Clearer.	Pitch.		Richer.	Displacement.
					h.	l.						h.	l.		
C	45°rf					1			2	2	1	1			4b
	90°r		1(3)	1		2			1	(1)		1			
	45°rb	1	2	1	1	3		1b	2	1			2		1f
G	45°rf	3	2					1f 1b	4		1				1f
	90°r	3	2					4b	3			1			3f
	45°rb	2(1)	4					2b	4	1					3f
Sc	45°rf	2	1		3	2		3f			1		3		2f 2b
	90°r	1	4			4		2f 1b		(2)		3	1		1f
	45°rb		3			5		1f	1	1		1	1		3f
		12(1)	19(3)	2	4	17			17	5(3)	3	7	7		

louder. In Table V. (standard 45°u) *up* means farther and *down* means nearer with respect to the aural axis and in Table VI. (standard 45°d) *down* means farther and *up* means nearer. Consequently the statement seems to be warranted here also, that, in the immediate vicinity of the aural axis, the nearer a sound is to the axis the stronger it seems, and *vice versa.*

TABLE VII.

STANDARDS 0° IN EACH OF THE THREE PLANES.

Observers.	Planes.	Up.										Down.									
		Intensity.		Distance.		Clearness.		Pitch.		Richness	Displacement.	Intensity.		Distance.		Clearness.		Pitch.		Richness.	Displacement.
		m.	l.	m.	l.	m.	l.	h.	l.	m.l.		m.	l.	m.	l.	m.	l.	h.	l.	m.l.	
	45°rf				2	1		1			1f	3			2						2f
C	90°r			1			1	2	1									1	3		
	45°rb		1		2			2		1	1f		1	1					2		2b
	45°rf		3	1			1				2b		4				2				1f 1b
G	90°r	1		1				1			1b	2			2				1		
	45°rb	1	2									1	2								3f
	45°rf	1			2	2					1f	3			2	1		2	1		1f
Sc	90°r		3			1	1	1	2				3		2				5		
	45°rb	1						1	2		3b 1f							1	3		2f
		4	9	3	6	4	3	8	5	1		9	10	1	8	1	2	4	15		

(*b*) The second element in importance is distance which we may assume to be intensity in other terms and accordingly the same statement applies.

(*c*) Clearness and richness of sound are less conspicuous but nevertheless very decisive factors.

(*d*) The effect of pitch is somewhat obscure. To begin with, the results are not so definitely inclined toward one or the other side. The most general statement that is allowed is that a sound higher in position seems higher in pitch and one lower in position seems lower in pitch irrespective of the aural axis. It would seem that the difference is rather apparent than real and that the coincidence of higher and lower positions with the names, higher and lower pitch respectively, may be a matter of association or suggestion.

(*e*) Misplacements are quite frequent. They are of two kinds, forward and backward, which renders them intelligible. Let us suppose that a sound in the upper front quadrant below its standard seems backward and the one above this standard seems forward. It is reasonable to interpret these misplacements in terms of intensity and distance since the downward sound would appear louder and hence nearer, but knowledge of the positions of the sounds would unconsciously forbid the misplacement to be nearer in a radial direction toward the head.

In a similar manner the upward sound seems fainter and hence forward, *i. e.*, farther away. Some of these misplacements may occur for other reasons such as, anticipation, slight subjective or objective changes, etc.

In Table VII., where the standards are at 0°, *i. e.*, on level with the ears, the figures are indecisive and sometimes apparently contradictory. Under the column *up*, four are louder and nine fainter; under *down*, nine are stronger and ten weaker. Altogether thirteen are louder and nineteen fainter. It might be said that since the standard is nearer the aural axis than either the *ups* or *downs*, all should seem weaker. But it must be remembered that the subjective aural axis is not in the same position for all individuals. However, it is also possible that the observer may pay more attention to the second stimulus (*i. e.*, an *up* or a *down*) than to the first stimulus (*i. e.*, the standard) because he knows the position of the standard and the *up* or the *down* is the one to be determined.

If the second stimulus receives more attention it may induce the tendency to perceive it as louder. But this can scarcely impair the validity of these tables because they are quite decisive in view of this possible condition.

2. *Theoretical.* — Both the introspections and the curves present very much the same general features in the vertical as in the horizontal measurements. The factors of intensity, distance, quality, etc., and accordingly the transitions and the variations in the basis of discrimination play practically the same rôle in the vertical planes as in the horizontal planes. In these respects there seems to be no essential modification caused by the tilting of the horizontal plane through an angle of 90° to make it vertical.

On the other hand, Bloch found that his observer localized more accurately in the aural axis than at the other surrounding standards. But do we not meet similar conditions in passing from the point overhead to the axis as in passing from the front to the axis? Why should localization be more accurate relatively, in the aural axis, in the vertical measurements, than in horizontal measurements?

Comparing the upper and the lower quadrants, there is a difference between the two in the absorption and reflection of sound by the clothes and body in the lower quadrant.

Comparing the composite curve of the vertical plane 90°r with the composite of the horizontal plane through the aural axis, we notice that the delicacy at the points above and below in the vertical plane is practically the same as at front and back in the horizontal plane. But at the other points localization is not so keen in the vertical as in the horizontal planes.

B. The Median Plane.

Median plane localization has long been known as least developed. Professor Seashore[1] found that, after all judgments correct by chance were deducted, there is a residual of eight per cent. and the implication is made that unfamiliar sounds

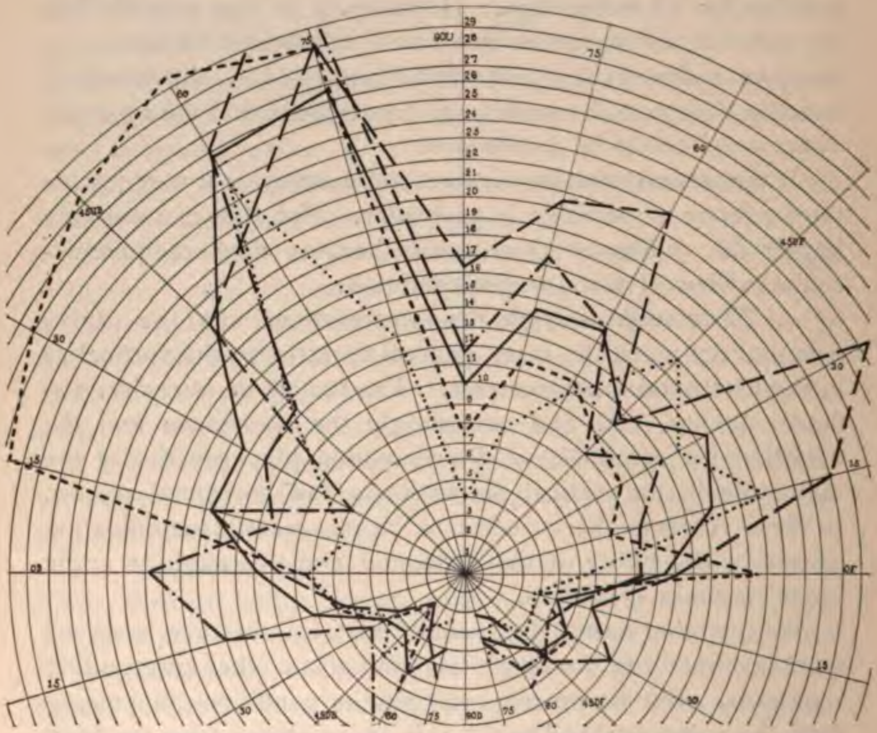


FIG. 24. Median plane.

---

[1] *Univ. of Iowa Studies in Psych.*, 1900, II., pp. 46–54.

in the median plane are localized correctly only as often as chance requires.

But the conditions are somewhat different in these experiments where the sound is familiar to the observer and where the locality in which it is expected, is known so that there is almost surprising ability in median plane localization.

The Curve.—(*a*) Discrimination is more accurate in the anterior than in the posterior half, and in the lower than in the upper half. (*b*) The points of relatively accurate localization are 90°u, 45°uf, 15°df–75°df, and 45°db.

Introspective.—To illustrate the process of localization we quote again from the records.

Standard 90°u. "The standard seemed to be at 60°uf. The fronts sounded to the right and the backs to the left. This distinction seemed simply chance."

Standard 90°u. Another observer. "The fronts seem stronger."

Standard 75°uf. "The ups seemed left and the downs right."

Standard 75°uf. "The ups seem richer and closer than the downs."

Standard 60°uf. "The standard seemed to be only 35° up instead of 60°. The ups sounded just a little up and to the right. The downs seemed exactly the same as the standard, only nearer."

Standards 60°uf, 45°uf, and 30°uf. "The downs seemed richer and nearer than the ups."

Standards 45°uf and 30°uf. "The ups seemed to the right and farther away and the downs seemed to the left and nearer."

Standard 15°uf and all standards below that. "The ups seemed richer and nearer than the downs."

Standard 30°df. "The downs seemed farther away."

Standard 45°df. "All sounds seemed back of me. There was a slight difference between the ups and the downs."

Standard 60°df. "The standard seemed 22°db and a little nearer than it is in front. The downs seemed a little to the right."

Theoretical.—That the posterior half of the median plane is much less accurate especially in the upper quadrant can be attributed to the fact that the pinnæ are not so well adapted to receive sounds from the rear. That the lower half is more accurate than the upper half is very probably due to the modifying effect of absorption and reflection of the body of the observer.

There are some quite definite distinctions between directions in regard to richness, intensity, and distance. In the anterior half there are two localities from which sounds are perceived more correctly than from the other localities, *i. e.*, there are two localities in which sounds seem richer and nearer. The composite curve has here two regions of more accurate perception of direction, 45°uf and 15°uf– 75°df. It seems probable that this condition is due to the pinnæ. Localization is more dependent upon the secondary factors.

These results are similar to those obtained by Bloch,[1] although the points do not coincide exactly, and his suggestion that the decreased delicacy between the two regions of more delicate discrimination is due to the tragus which hinders accurate perception, receives further support from these results. There is a rise and then a fall of the composite curve at 60°db which is probably due to the interference of the lobus and antitragus if we follow out the suggestion of Bloch.

AUDITORY DISCRIMINATION ELLIPSES.

Fig. 25 epitomizes the results of both horizontal and vertical measurements. The conception of sensory circles on the skin suggested this scheme of representing the space discrimination in the field of hearing. The figures may properly be called auditory discrimination ellipses. The vertical and the horizontal planes studied are represented by the straight lines, whose intersections represent the points used as standard directions in the experiments. This chart therefore corresponds to Fig. 2, and represents the right hemisphere in the field of hearing. The horizontal and the vertical axes of the ellipses represent the two measurements made at each point. As in sensory circles on the skin, we may imply that any axis of one of these ellipses represents the probable discrimination for points touched by that axis. Thus, in the ellipse at 90°r, plane 0, the horizontal axis represents 4.5°, the vertical axis 8°, and the axis with an inclination of 45° represents approximately 6.5°. This chart, then, exhibits all the numerical results of the two leading series of experiment in a graphic way.

GENERAL OBSERVATIONS.

1. Some additional observations were made which are either on accompanying phenomena or possible data for localization.

(*a*) Visual imagery of the position of sounds was very prom-

---

[1] *Bloch, loc. cit.*, p. 42.

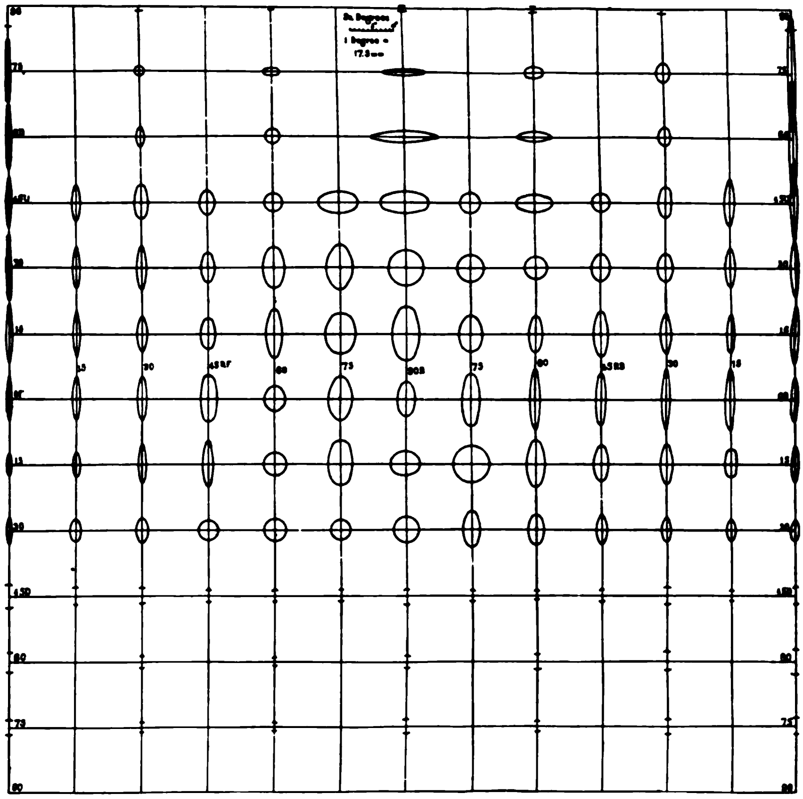


FIG. 25.

inent in the judgments of all observers. Very frequently they were conscious of scarcely anything beyond visualization. If the standard was visualized in another than its true position it was at times disturbing. This was most noticeable in the horizontal planes 60° and 75° above the aural axis, where a standard could be imagined as located in any position overhead.[1] Münsterberg[2] also found that if the observer fixated his attention upon a certain point misplacements were made that did not occur otherwise.

(*b*) With one observer tactual sensations were apparently a subsidiary means of distinguishing directions. 'Sounds from different directions strike the pinna differently' was the often repeated remark. He also seems to have been quite consistent in his perception of apparently different cutaneous sensations since at a certain standard he stated that the 'sounds do not strike the ear differently'; and, as the curve indicates, this is the least accurate position. It seems hardly probable that cutaneous sensations are as important as they seemed to be for this observer. It is a well known experience that if one directs his attention to any part of the body, the organic sensations of that part rise into consciousness. On the other hand, the directing of the attention to it would make more acute any differences of cutaneous stimulation that might be due to sound. But the evidence furnished by a special experiment on this point by Angell and Fite[1] seems quite conclusive to the effect that 'cutaneous sensations constituted a small part, if any, in the data of localization.' Their experiment was concerned not with the pinnæ themselves but with the surrounding parts, and it does not absolutely disprove the statement of Wundt,[2] that the pinnæ are delicately sensitive to pressure on account of the presence of tiny hairs. Further experiments are necessary to determine whether cutaneous sensations play a part in localization.

---

[1] Angell, *loc. cit.*, p. 14.

[2] *Loc. cit.*, p. 470.

(*c*) Motor adjustment or the tendency to turn and face the sound was observed a few times, and turning the eye-balls in the direction of the sound was noticed more frequently.

2. A few very striking misplacements occurred which can be described by quoting from the records.

Vertical plane 15°rb. Standard 30°u. "The standard seemed to be 50°rf, 20°u, and eighteen inches away from the head. The ups were 15°rf, 60°u, and four feet away. The downs were 15°rf, 30°u, and one foot away." This misplacement occurred only three or four times and was especially conspicuous with one observer. In each case it was noticed in the same locality, *i. e.*, in the rear quadrant. A similar misplacement was found in the median plane.

Standard 45°ub. "The standard seemed 60°lf, 15°u, and two feet away. The ups seemed 45°lf, 45°u. The downs seemed straight back on level with the ears and a little nearer than they actually are."

Standard 30°ub. "The standard seemed to be at 60°lf, 15°u, and two feet away. The ups seemed 20°lf, 60°u, and six feet away. The downs seemed just back of the head and a little to the left."

3. After all the trials at a certain standard had been made,

---

[1] *Loc. cit.*, p. 236.

[2] *Physiologische Psychologie* (5th ed.), II., p. 487.

it was noticed that nearly all trials were errors. The experimenter then wanted to take a larger step, but this proved a surprise to the observer, because he had felt quite certain of his localizations and thought that he had made only a few errors. It was then suggested that he had probably reversed his process of localization for some unknown reason. The same interval was then tried again, but the observer always answered the opposite from what the direction seemed to be, for example, if a sound seemed above the standard he called it below. It was then found that he made only a few errors with the same interval. This occurred with only two observers and at the following standards: V. plane 60°rf, St. 15°u; V. plane 30°rf, St. 60°u; V. plane 60°rb, St. 15°u and St. 30°u; V. plane 45°rb, St. 0°; V. plane 30°rb, St. 60°u.

4. Comparing the first section of the double fatigue order with the second there is some improvement in the perception of direction, especially in the median plane. Pierce[1] has demonstrated that median plane localization is subject to much improvement. He concludes that 'if the exigencies of life required, an ability to locate sounds perfectly [*sic!*] within the median plane could be acquired.' The prediction of v. Kries[2] who said that, median plane localization may be possible 'wenn so zu sagen bereits erlernt ist, wie er [the sound] von vorn her und wie er von hinten her klingt' is fully verified.

5. After a large number of stimuli had been given on the right side in passing, for instance, from front to back it was very frequently observed that in testing the last point, 0°b, the standard seemed 10° or 15° toward the left instead of directly back and the sound on the left seemed much farther to the left than the one on the right seemed to the right. This was common to all four of the regular observers. Whether this is a characteristic of attention or a result of greater fatigue of the right ear is not certain. Professor Angell[3] mentions similar misplacements toward the unfatigued ear. Münsterberg and

---

[1] *Loc. cit.*, p. 103.

[2] Ueber das Erkennen der Schallrichtung,' *Zeitsch. f. Psych. und Physiol. d. Sinn.*, 1890, I., p. 237.

[3] *Loc. cit.*, p. 10.

Pierce[1] on the other hand find that only one out of five observers misplaced sounds after one ear was unusually fatigued.

6. The four regular observers may be divided into two types. In the one type, *W* and *S*, the curves are quite near to the center while in the other type, *K* and *B*, they sweep out farther. This suggests individual differences in shape and contour of the outer ear, differences in mental characteristics, as, in the retention of auditory images, in the presence or absence of visual imagery, etc. From another point of view there are types of observers according to the prevalence of misplacements, intensity, distance, quality, etc., in localization.

7. The fact that the sound was uniform through all the experiments and the resulting familiarity of the observers with it had marked influence upon the absolute accuracy of localization, but the validity of the comparative accuracy of the different directions is not thereby impaired.

SUMMARY.

A twofold aim was stated at the outset. In regard to the discrimination between directions, the results show that:

1. In the horizontal planes, localization is most accurate in front, nearly as accurate in the back, and least accurate at the side. In the vertical planes excluding the median plane, localization is most accurate above and below, and least accurate at the side. In the median plane, localization is less accurate than in any other plane; it is more accurate in the anterior half than in the posterior half.

2. The delicacy of localization does not decrease gradually in passing from the median plane toward the side either in the horizontal planes or in the vertical planes, exclusive of the median plane. There are five curve prominences, *i. e.*, localities of less accurate localization, in passing from front to back, or from the point overhead to the point below.

In regard to data and elementary processes, the results show that:

3. In the greater part of the field, the localization depends chiefly upon the ratio of intensities received by the two ears.

---

[1] *Loc. cit.*, p. 471.

4. But within a considerable area around the aural axis, the localization is almost entirely monaural; yet intensity plays an important rôle.

5. It depends also upon other quantitative and qualitative characteristics, such as, apparent variations in intensity and distance, richness, clearness, timber, pitch, etc.

6. Variations in the characteristics of sounds occur systematically. In the immediate vicinity of the subjective aural axis, sounds nearer to the axis seem louder, nearer, richer, and clearer than sounds farther away. About the middle of each quadrant, sounds seem fainter and farther away. There are changes from binaural to monaural localization, and from monaural to binaural localization. There are also variations in the data of both binaural and monaural localization.

7. Corresponding to the variations in the data of localization there are changes in the process of localization. There are five transitions, which correspond to the five curve prominences.

8. Other features are, cutaneous sensations, motor sensations, visualization, and illusions of misplacements.

PERIODICITY AND PROGRESSIVE CHANGE IN CONTINUOUS MENTAL WORK.

BY C. E. SEASHORE Ph.D., AND GRACE HELEN KENT, A.M.

This study of the fluctuations in the efficiency of continuous mental work deals with three distinct processes: sensibility, discrimination, and memory. The experiments accordingly fall into three series. The common aim in all the series was to secure records of continuous work in representative processes under satisfactory experimental conditions. The most essential of such conditions were that the processes should be natural, definite, controllable, repeatable, recordable, and relatively free from varying associations, and that the elements of the processes should be as constant as possible, even throughout long-continued repetition.[1]

Fatigue[2] was the primary object of interest and search, but that illusive yet ever intrusive factor is almost hopelessly lost in the umbrage of related processes. Our leading effort has been to secure reliable and analyzable records of work done, then to discover the actual fluctuations in such work, and eventually to trace in part the rôles played by known factors as causes of these fluctuations.[3]

SERIES I. SENSIBILITY.

Problem, Apparatus, Method, and Observers.

The experiments in this series deal with the fluctuations in auditory sensibility which result from continuous work in listening to a liminal tone. The act which constituted the work consisted in *determining the moments of appearance and disappearance of a tone which oscillated 'incessantly' about the threshold.* In the following discussion, one such double determination will be spoken of as a single act — the act. The work of the whole period of an experiment consisted in the continuous repetition of this simple act. The serial record of the two thresholds which were thus determined constituted the measurement.

---

[1] The writers of this article are deeply indebted to the work of Dr. Florence Brown Sherbon whose experiments on the same subject, in this laboratory, preceded the present research. Both in the planning of our experiments and in the interpretation of the results, we have used freely the knowledge gained through the earlier work.

[2] My article on 'The Experimental Study of Mental Fatigue,' PSYCH. BULL., 1904, I., 97–101, constitutes the logical introduction to this report. C. E. S.

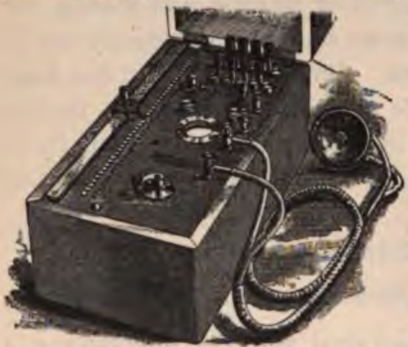
[3] The reader may profitably turn to Part IV. and read the 'General Conclusions' first; he will then be able to read the detailed account of the experiments more critically, having the full scope of the work in view.

The stimulus was a continuous tone of variable intensity, produced by a 100 v.d. electric tuning-fork, through the audiometer.

Since some idea of the construction of the audiometer is necessary for the understanding of this report, we herewith insert, for the convenience of the reader, some extracts from the original description.[1]

THE AUDIOMETER.

The essential and unique feature of this apparatus consists in the method of varying and measuring the relative intensity of the sound. This is accomplished by applying the principle that, for certain given relations between the primary and the secondary coils of an induction coil, the induced current varies directly with the number of turns of wire in the secondary coil. The complete apparatus consists of an induction coil, a battery, a galvanometer, a resistance coil, switches and a telephone receiver, all except the receiver being built into one compact and portable piece.



A dry battery is so connected that it may be thrown into the primary circuit of the induction coil by turning the left-hand switch. The galvanometer, seen through the crystal in the center, may be thrown into circuit by turning the right-hand switch. The fall of potential over the primary coil is reduced to the standard e.m.f., by varying the resistance by means of the plugs at the farther end of the chest and gauging it by the galvanometer. The resistance permits of as small variations as can be detected by the galvanometer; and the galvanometer detects smaller variations in the current than can be detected by the ear at the receiver. The lever at the near end of the chest is a key which is used for the rapid closing and opening of the primary circuit in producing the stimulus. No current is drawn except for the moment that the circuit is closed by this key. The primary coil is longer than the secondary. The latter is wound in forty sections, arranged in a series according to the number of turns of wire that each contains, as may be seen in the accompanying table. Each of these sections is so connected with the surface terminals along the scale that the spring contact on the sliding carriage throws into circuit the number of sections indicated by the numbers on the scale. Therefore, to vary the energy communicated to the receiver in this circuit, it is necessary only to move the carriage along the scale to the proper terminal. As it is most convenient to vary the stimulus in a geometric ratio according to the psycho-physic law, this principle has been taken as a guide in determining the scale of intensities of the sound. The numbers on the audiometer scale are given in the first column in the accompanying table; these indicate the corresponding number of sections involved in the secondary circuit. The second column gives the corresponding number of physical units in terms of the total number of turns of wire in circuit. The ratio of the increments in the sound is such that the forty steps in the series are, as nearly as can be determined, psychologically equal. The serial numbers on the scale are used in all readings. These measurements all refer to the strength of the current which energizes the receiver. The functional relation between the strength of current and the amplitude of vibration in the receiver is somewhat complex, but for the present purpose it may be regarded as fairly uniform.

---

[1] Seashore, 'An Audiometer,' *Univ. of Iowa Stud. in Psych.*, 1898, II., 158–163.

Table of Values for the Audiometer Scale.

I.	*II.*	*I.*	*II.*	*I.*	*II.*	*I.*	*II.*	*I.*	*II.*
1	1	9	9	17	32	25	107	33	368
2	2	10	11	18	37	26	125	34	429
3	3	11	13	19	43	27	146	35	500
4	4	12	15	20	50	28	170	36	583
5	5	13	17	21	58	29	198	37	680
6	6	14	20	22	68	30	231	38	793
7	7	15	23	23	79	31	270	39	925
8	8	16	27	24	92	32	315	40	1079

I., scale on the audiometer.

II., corresponding values, *i. e.*, number of coils in the secondary circuit.

The range of the intensity of the sound is such that it is not probable that any person can hear the weakest sound and all who can hear ordinary conversation at all can hear the strongest sound. The average threshold for normal ears lies near the middle of the scale.

For certain tests by aurists and experiments in the psychological laboratory, it is desirable to have a tone instead of a click for stimulus. Provision has been made for the production of tones in the audiometer. The inside connections are so arranged that by attaching a double contact electric tuning-fork to the binding posts seen to the right, the fork may be made to interrupt the primary circuit of the audiometer and thus produce the tone of the fork in the receiver. This tone may be varied and measured in the same way as the regular stimulus.

An electric sounder in the measuring-room was connected with a light strap key held freely in the hand of the observer in the observing-room. The motor process which was necessarily involved in the act as defined above, and constituted the response of the observer, consisted in keeping the key closed when he heard the sound and open when he did not hear it.

The strength of the sound at the time of closing the key was recorded as the upper limit of the threshold and at the time of opening the key as the lower limit of the threshold. These two limits may be called, respectively, *To* and *Tu* ('threshold over and threshold under').

The intensity of the sound was varied by moving the carriage of the audiometer over the scale of psychologically equal units of difference in intensity. The experimenter was guided by a metronome in moving the carriage at the rate of one step per second. Starting at a point below the threshold, the carrier was moved upward at this uniform rate until the *To* signal indicated that the sound was heard; the direction of movement was then immediately reversed and continued at the same rate until the *Tu* signal was heard indicating that the sound had become inaudible; the direction of movement was then immediately reversed again and continued as before, thus making a continuous oscillation about the actual threshold throughout the whole experiment. It is evident, therefore, that the quality of the record depended upon the alertness of the observer and that the height, width, and uniformity of the threshold constitute relative measures of the efficiency of the observer at any given time.

Each experiment was continued two hours, which is a long period for continuous and homogeneous work, and probably long enough to bring out the normal fluctuations for any ordinary single period of work. The observer was seated as comfortably as possible in the observing room.[1] The room was dark and quiet and there was no avenue of communication except the signals described. The observing room is 12′ 2″ × 12′ 7″ × 10′ 8″. No ventilation was carried on during the experiment period, but the room was thoroughly ventilated with fresh air by an electric fan just before each experiment and the observer was alone in the room.

The experimenter had an assistant to record the readings from the audiometer and to divide the record into five-minute periods. In all except experiments III. and X., a telephone receiver with a head clasp was used and tied lightly to the head of the observer with a band in order to secure constant adjustment. Other particular precautions will be discussed later.

---

[1] This room is described in *Univ. of Iowa Stud. in Psych.*, 1902, III., 140. Ordinarily it is relatively sound-proof, light-proof, and jar-proof, but at the time of these experiments, there was a temporary disarrangement by which this room made contact with the main building. Therefore it was not so quiet as would have been desirable; strong sounds from the outside could penetrate faintly.

The conditions thus briefly described comply fairly with the requirements as laid down at the outset. The act was natural — 'Hold the key down while you hear the sound.' It was definite: the only question which should arise was, 'Do I or do I not hear that particular sound' — and that was the question continually in the mind; the audibility of the sound at every moment was the element measured; the act was simple, familiar, and clear cut. It was controllable; the stimulus was under control, and ordinary disturbances were excluded. It was repeatable; the setting did not change by repetition and the progressive change in the internal nature of the act was open to analysis on the ground of known conditions.

The real work was in the cognitive process. The motor process was practically automatic; it was not wearing but, on the other hand, afforded a sense of relief from the otherwise restricted attitude.

While this positive statement of successful attainments is true in the relative sense in which we describe and control psychological conditions, the very rigidity of the conditions revealed shortcomings not otherwise noticeable, and no one can be more cognizant of these than the experimenters. Even if not expressly eliminated, such factors will be duly weighed before reaching our final conclusion.

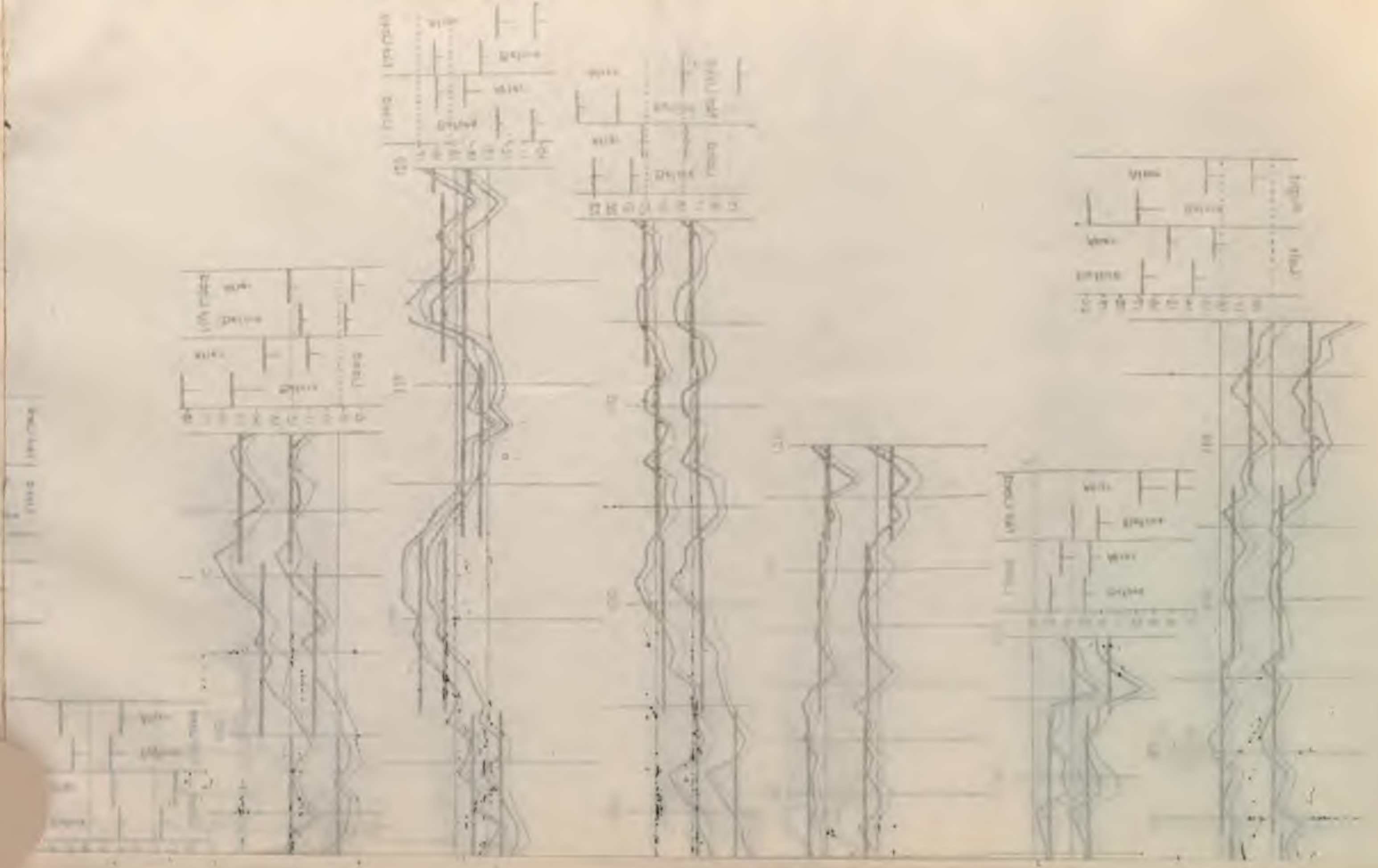
There are two fundamental factors in a continued threshold test of this kind. One is the change in the physiological irritability of the peripheral organ and the other is change in the central power of concentration of attention. The latter would be the same for the two ears; therefore any change in the sensibility of the unused ear that may take place during the experiment is probably central. This fact suggests a simple test which would seem to be concise and crucial, but we encountered very serious obstacles in the way of controlling the conditions. Immediately before and immediately after the two-hour period, a test of twenty trials was made upon each ear, in the double fatigue order, by the same method that was followed in the main experiment. The object was to determine the threshold of each ear, under similar conditions, when rested and when fatigued.

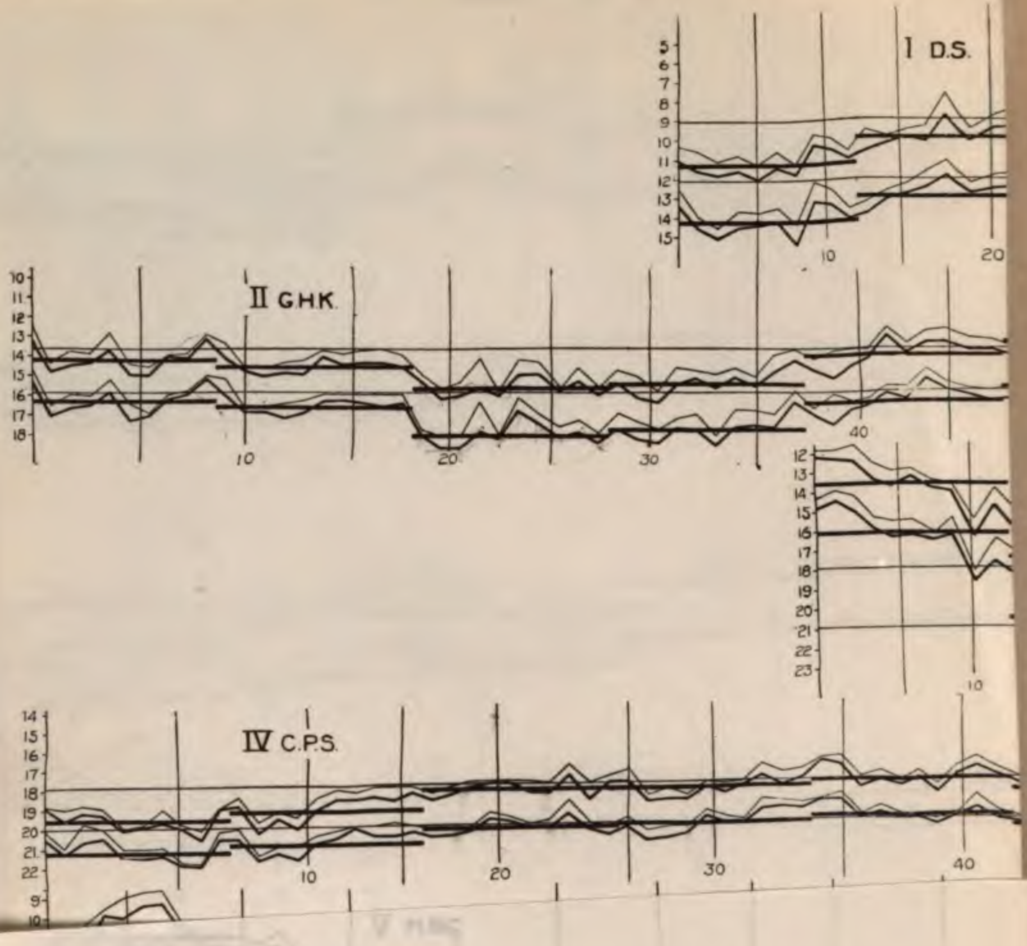
There are ten experiments in this series taken on as many observers, but all under similar conditions. The observers in experiments I., III., IV., VI., VII., VIII., and IX. are men and in experiments II., V., and X. women. These ten persons represent widely different degrees of practice, general efficiency in observing, and endurance. I. (D. S.), scholar in psychology, was thoroughly familiar with the situation and the conditions of the experiment. II. (G. H. K.), also scholar in psychology, and III. (C. E. S.) were the writers. X. (A. W.) was a first-year student in psychology, somewhat familiar with laboratory methods, but was not trained as an observer. .The other observers were all students in the technical laboratory course and, with the exception of VIII. (O. H.), had had more than half a year of training as observers in the course. All knew the purpose and conditions of the experiment and took an active interest in it; but none of the observers, except the experimenters, had seen any other record of the kind.

Each observer was allowed a preliminary practice of from two to five minutes, according to need, — enough to make the requirements and the nature of the experiment clear. This small amount of practice was quite sufficient because the act was extremely simple and all, except observer X., had previously served both as observers and experimenters in the measuring of hearing ability by this very method and apparatus.

Explanation of the Records.

The records consist of two series of numbers representing, respectively, the successive readings for the just perceptible sound, *To*, and the just non-perceptible sound, *Tu*. The numbers of each series were averaged by tens and by hundreds, and the mean variation found for each group of ten. Instead of printing tables, we present the results in the form of curves. This method is economical and throws the results into a better single perspective than could be obtained from the tables alone.


Right
Left
Before
After
Used
Not Used


I D.S.
5
6
7
8
9
10
11
12
13
14
15
10
20
II G.H.K.
10
11
12
13
14
15
16
17
18
10
20
30
40
12
13
14
15
16
17
18
19
20
21
22
23
10
IV C.P.S.
14
15
16
17
18
19
20
21
22
10
20
30
40
9
10

These curves constitute Fig's I. to X. in Plates I., II., and III. Fig. I. *a*, in Pl. I. is a representation in detail of the *To*-measurements of experiment I., Fig. I., which will be explained later.

Each of the curves represents a two-hour record of one observer. The vertical lines divide the records into five-minute sections. The light horizontal lines which extend the full length of the record show the average for the entire period, the lower being *To* and the upper *Tu*. The heavy horizontal bars mark the averages by hundreds. The heavy zigzags show the averages by tens, and the light zigzags, which are drawn on the heavy zigzags as base, show the mean variation for each of these tens. The figures at the left end give the scale of intensities in terms of the readings of the audiometer. For the purpose in hand, it is sufficient to remember that the smaller the number, the better the sensibility; so that the higher a point in the curve is, the keener sensibility it represents.

The audiometer was adjusted to different standards for different observers, in order to bring the threshold within the most convenient range of the scale; hence the absolute heights of the thresholds for different observers are not to be compared.

The observers indicated, by signals, the time of all special disturbance and had separate signals for subjective and objective disturbances. In the tabulation of the results the record of the act at such a signal was recognized only for its time-value.

The results of the before- and after-tests are represented graphically at the right end of each curve. The long average-lines of the main record are represented by dotted lines for the purpose of facilitating comparison. The horizontal lines show the average *To* and *Tu* before and after. Each is the average of twenty trials, the mean variation of which is represented by a vertical line upon the horizontal. The units in the scale of intensities are on the same scale as in the main curves.

Criteria of Change.

At least three criteria may be taken into consideration in an attempt to evaluate the efficiency of the work represented in these records. They are: (1) The height of the threshold; (2) the mean variation; and (3) the width of the threshold.

The first is self-evident: the higher the curve, the keener the sensibility. It is a quantitative measurement.

The mean variation may be large or small regardless of whether the sensibility is keen or dull. In this experiment it is probably not a measure of the sensibility of the sense organ, but of the power of concentration of attention. It is, however, a measure only so long as there is a continuous, maximum effort of concentration, which is the condition sought in these experiments. Even then it must be interpreted with great precaution and only in the light of introspective accounts.

The width of the threshold, which is the difference between *To* and *Tu*, depends upon the alertness of the observer. Slow reaction tends to give a low *To* and a high *Tu*, thus increasing the difference in both directions. A wide threshold means a long act; hence the number of acts in a given period varies inversely with the width of the threshold. The width of the threshold in records III. and X. is due in part to the method of reaction employed by the experimenter in these which were the first two experiments, but the method was uniform throughout the records. With this limitation, the characteristic width of each record is probably an expression of the personal equation of the observer. It may be assumed, other things being equal, that a narrow threshold indicates alertness, *i. e.*, steady keenness in discriminative attention. The principal counter-factor is the tendency to automatism. The automatism is at least favored by the approximate coincidence of the time of hearing with the high crest of the normal attention-wave. The feeling of 'let it go' came not only from the physical change in the stimulus but also from the termination of the subjective attention-wave. One of the writers experienced that very distinctly in the special experiment on that point (see p. 60, following).

Before we make any physiological or psychological interpretation of the records, we must inquire whether the fluctuations may not be due to changes in the stimulus. We have taken every precaution to keep it constant. The receiver on the audiometer is of good quality and well seasoned; we used the Edison-Lelande cells; the temperature was practically constant; as the interruption by the fork took place in a shunt circuit, the main circuit remained permanently closed; and the current was minimal so that there could not be serious danger from permanent self-induction. Therefore, although we have no absolute proof of the constancy of the stimulus, we must proceed on the assumption that it remained at the same standard. We may also invoke the evidences obtained in other series of experiments and especially those on sight. As will be seen, the conclusions drawn from this series on sensibility are all corroborated by the experiments in the two following series. They were also corroborated in visual experiments in which we had absolute control of the stimulus.

Periodic Change: A. Hour-waves.

The most salient feature in the records, especially with reference to the height of the threshold, is a periodicity. The records agree in showing at least two sets of rhythmical fluctuations; and, in addition to these, there enters the well known attention wave, which practically coincides with the individual acts and therefore does not appear as a wave in the record. For convenience, we may designate the three sets of waves, respectively, as

1. The hour-waves (20 to 200 minutes).
2. The minute-waves (½ to 20 minutes).
3. The second-waves (a few seconds).

The hour-wave can be seen most clearly by following the main zigzag lines showing the averages by tens. In some records two sets of hour-waves are discernible. For convenience we may call them the large and the small. The dividing line between the two groups is arbitrary and may be taken at about thirty or forty minutes.

In order to show approximately the number and length of the hour-waves a diagrammatic table, Table I., is given showing the upper and lower points, the crest and the basin, of each wave. The numbers denote the time, counting in minutes from the beginning of the test, and they are placed in an upper or a lower line according as they represent high or low points in the waves. The wave-length is proportional to the horizontal distance between the numbers, but differences in height are not

TABLE I.

PERIODS OF THE HOUR-WAVES IN FIGS. I. TO X.

I.		5									50			65			80		90						120
I.		5			20		30				50			65			80		90				110	115	120
II.	0						30						60						90					115	
III.	0															75								115	
III.	0				20			35		45		55					80				100		110	115	
IV.		5						35					60					85						115	
IV.		5			20	25		35			50		60			75			90		100	105		115	
V.		5										55						85			100		110	115	120
V.	0	5		15	20			35		45		55	60			75			90		100		110	115	120
VI.		5		15		25		35					60						90		100		110		
VII.	0				20				40				60			75		85			100		110	115	
VIII.	0						30					55		65		75					100				120
IX.		5		15		25			40		50		60		70		80		90			105			120
X.		5								45									90					115	
X.	0		10		20	25				45	50			65					90		100		110	115	120

shown. In these estimates, *To* is taken as the principal guide because it is a more reliable index to the moment of perception than *Tu*; the appearance of a sound can be determined more definitely than its disappearance.

The estimates in this table are, of course, somewhat arbitrary. In many cases there is latitude for differences in interpretation. The table represents the estimates upon which the writers have agreed. In five records, (I., III., IV., V., and X.) large and small hour-waves are discernible in more or less distinct sets, as indicated in the table. II. and VIII. might also have been divided into short waves, but these waves are not very distinct.

The waves vary not only in length but also in form. While the general tendency is an approximation to the sine curve, this form suffers all sorts of distortion. On the assumption that there are two or more sets of waves, one can readily see the effect of interference and reinforcement. But many sporadic variations seem to be due to aperiodic influences.

One very expressive feature is that there is a tendency for the hour-wave to be shorter in the latter half of the record than in the first. This may be seen on a glance at Table I. Where there are two sets of hour-waves there is a tendency for the two to coincide near the end. Compare the two sets of waves, *e. g.*, in Record I., Table I.

One might suppose that every record should begin with a high crest, but there is no constant tendency in that direction.

Periodic Changes: B. Minute-waves.

We have spoken of the main curves as zigzags. These zigzags bring out the minute-waves. In order to show these short waves more clearly than they are shown in the curves of averages, a section of the *To* from each of the ten curves is represented in detail (Pl. II.). All these sections begin with the beginning of the second half hour of the record and include two hundred acts. This portion of the record is selected because it is perhaps freest from erratic variations, coming as it does after a period of adaptation and before the onset of discomfort.

Fig. I*a*, Pl. I., represents the whole *To*-record in this manner for Record I., to which it runs parallel. It shows how the minute-waves enter as partials in the hour-waves.

The tendency toward periodicity is unmistakable, but the waves are not homogeneous, nor are they limited to one system. Here, as in the longer waves, different sets of tendencies are operative producing reinforcements, balances, or interferences.) One wave appears as a partial in another and is itself made up of ripples. A minute-wave may be a partial in an hour-wave; there is a gradual transition from one to the other.

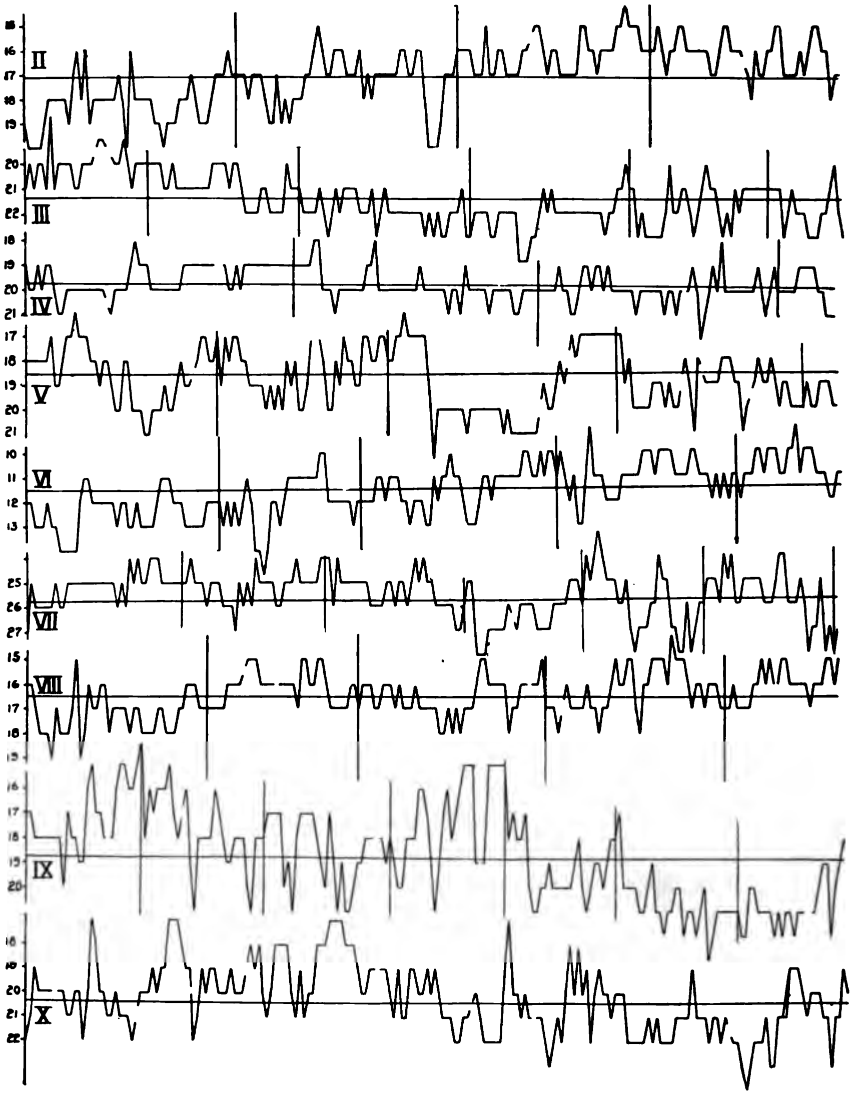


PLATE II.

Periodic Change: C. Second-waves.

The attention-wave of Urbantschitsch[1] plays an important rôle in this work. It is unnecessary to enumerate here the conclusions of the valuable researches on that wave. We have assumed its existence and it remains to point out under what conditions it entered into the present process. We shall try to show that the attention-wave in this experiment is synonymous with, or rather, constitutes, what has been defined above as the second-wave.

---

[1] *Med. Centralbl.*, 1875, 628 ff. Good summary accounts are found in Titchener, *Exp. Psych.*, 'Instr. Man'l, Qualitative,' 194 ff., and in Wundt, *Physiol. Psych.*, 5th ed., III., 366 ff.

The act which is the object of study in this series on sensibility, as defined on page 3, forms a peculiar basis for the second-wave. Owing to the method employed in recording, these waves do not show in the records, but the known conditions and requirements and the introspective accounts furnish us satisfactory evidence of their existence.

The act may be regarded as the basis for one wave or for two, according to the point of view taken. According to the former, not only is the duration of each act approximately the length of an attention-wave, and its recurrence periodic, but the stimulus constitutes a wave in its intensity change — rising from an imperceptible stimulus, through the just perceptible, to the more than just perceptible, and then back, receding to the non-perceptible. Corresponding to this, there is a complete wave of consciousness, for, on account of associated imagery, the subliminal part of the wave is as concrete in consciousness as the supra-liminal part.

According to another point of view, the act readily divides itself into two complete and distinct movements of attention, the maxima of attention being just before *To* and *Tu*, respectively, and the corresponding minima immediately after these points. The two waves in an act differ quite radically in character, but they both serve the same purpose, namely, rest through relaxation of attention. A moment of relaxation followed the perception indicated by *To* because the sound grew relatively strong during the united reaction-time of the observer and the experimenter; and, the approximate duration of this intensity was known from the preliminary practice. Then a moment of relaxation followed the perception indicated by *Tu*, from the conviction that the sound had gone below the threshold and there would be a certain appreciable time before it could return. Thus, in one case the attention relaxed for a moment because the sound was so strong that it could be heard with ease, and in the other because the observer assumed that, for the moment, it was inaudible. Similarly the knowledge of the periodicity in the stimulus enabled the observer to concentrate attention at the probable appearance of the thresholds *To* and *Tu*.

In order to compare the work in which the second-wave is merely subjective with that in which it is also objective, Observer III. took a special test. The same apparatus was used as before but, instead of a sound varying about the threshold by actual change in intensity, the stimulus consisted of a liminal sound of constant intensity, and the observer recorded the subjective fluctuations by holding the key down while the sound was heard and free while the sound was not heard. In order to minimize the tendency to hallucination, a one-fifth second interrupter was substituted for the fork. A graphic record was taken by means of the multiple recorder.[1]

The experiment covered a period of two hours. From the facts learned in the foregoing experiments, it was evident that one intensity of sound would not remain liminal throughout that long period. Therefore we adopted the arbitrary method of raising or lowering the intensity of the sound by one step on the audiometer when the sound had been heard or not heard, respectively, for a continuous period of thirty seconds.

The experiment was made 3:17 to 5:17 p. m., April 14, '04. The introspective account follows:

> I was in fairly good condition for afternoon work. Thought that probably I had remained at the same standard all the time because I was not aware of having had any periods long enough to call for the change. The subjective standard was retained satisfactorily throughout.
>
> The wave seems to be dependent upon voluntary effort to a large extent. At times I would feel, 'now I have held it so long that I must give up in order to be able to continue.' Very many of the fluctuations are due to slight disturbances, both subjective and objective. The tendency to fall into an automatic rhythm is especially dangerous. For these reasons I do not place much significance upon the length of the waves. Yet the objective disturbances were only such as we notice when ordinary disturbances are excluded, and the rhythm is in part really what we seek.

---

[1] The recorder is described in *Univ. of Iowa Stud. in Psych.*, 1901, III., 1–16, as a part of the psychergograph. In its present form, fountain pens are used in place of the lead pencils, and an electric motor is used instead of the clock-work.

The heard sound varied within wide limits; at times it seemed as much as five points stronger than the barely perceptible, and I was able to notice distinct wavelike rises and falls in intensity. This experiment is more taxing on attention than the other experiments (Series I.).

Let us first observe the bearing of this special experiment upon the interpretation of the second-wave in the main experiment. Fig. 11 shows the numerical distribution of the different lengths of the attention-waves — the solid line for 'sound heard' and the dotted line for 'sound not heard.' The length is represented in seconds on the base-line and the vertical scale shows the number of cases at each level. The period for which the sound is heard most frequently is 6 seconds, and the period of greatest frequency for the sound not heard is 3 seconds. The curve rises at 30 because that point includes all that would have been longer than 30 seconds if the standard had not been changed at that mark.

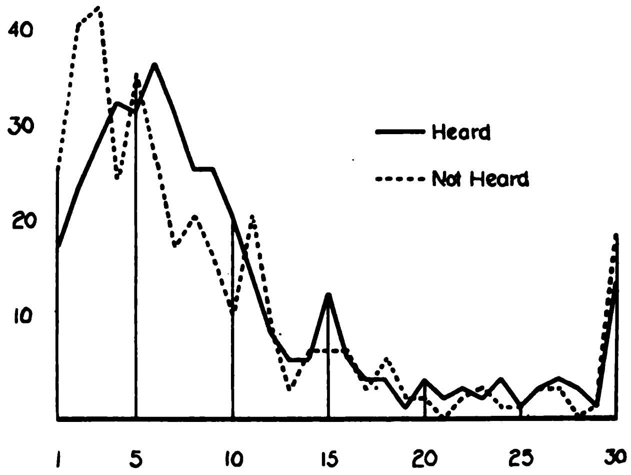


FIG. 11.

The most frequent length of the complete attention-wave in the special experiment is, therefore, about 9 seconds. The average duration of a complete act in the main experiment upon this observer (see Fig. III. in Plates I., II., and III.) was 8.4 seconds. That is, the typical attention-wave, purely subjective, coincides well with the objective wave in an act. In a way, the periods of supra-liminal sound correspond in the two experiments, so that we may say with reference to both that the sound was heard during the attention-wave and not heard during the inattention wave, provided we count the threshold transition periods with the former.

This wave which coincides with the act is a wave of secondary passive (Titchener) attention.[1] Within it, we find two distinct waves of active attention. Such is the case both in the experiments in this series and in the classical experiments upon the attention-wave.

Since the average length of the act was 8.4 seconds for Obs. III., the length of each active attention-wave was about half of that, or 4.2 seconds, in accordance with the conditions of the experiment. It is safe to estimate that the period of effort occupied about 3 seconds out of the total, and the period of absence of effort the remaining 1.2 seconds.

The interpretation of the combination of the two forms of attention may be illustrated by the schematic diagram, Fig. 12. The scheme applies both to the special act in this series where there is an objective basis for the rhythm and to the familiar attention-wave where the rhythm is purely subjective. We shall apply the scheme to the former first.

The dotted line *ABC* represents the change in the intensity of the stimulus, and the horizontal base-line the mean threshold value of the stimulus. Then *To* falls at *A* and *C*, and *Tu* at *B*. The curve *DEF* represents the form of distribution of the secondary passive attention, the part above the base-line indicating presence of this form of attention and the part below, absence. The curves *GHI* and *IJR* represent the form of distribution of the active attention-waves.[2]

The figure thus throws into clear perspective the result of the analysis of the complete attention-wave into its two component elements and suggests the general outline of the resultant of the two. There is a state of attention from *G* to *E*, but it differs in kind and strength, and the wave is not smooth, as has been supposed; it has three distinct prominences. The crests of the waves *GH* and *IJ* are the result of special effort, while the longer crest in *DE* represents no effort and yet a state of clear attention. But the three elevations are parts of a single phase of a long wave *GE*, because the attention is continuous during that period.

---

[1] For brevity, it will be spoken of hereafter as the passive, with the understanding that the *secondary* passive is meant.

[2] To coincide with the act as described in the main experiment, this diagram should really begin at *I* and make a complete cycle from that point instead of from *G*. No account is taken of the difference in the level of *To* and *Tu*.

The period of inattention is short — only from *E* to *R*. But the period of absence of active attention does not coincide with the period of passive attention; they change off in part, as it were. The former runs from *J* to *R* and the latter from *E* to *F*. Therefore the rest from attention is not of uniform nature, any more than the attention was of uniform nature. From *B* to *C* no sound is heard; from *J* to *E* there is complete rest as regards active attention, but the passive lags; from *E* to *R* is a period of complete inattention; and from *R* to *F* only the passive attention is absent. Of course, the significance of these differences below the threshold must be interpreted in terms of the subconscious states.

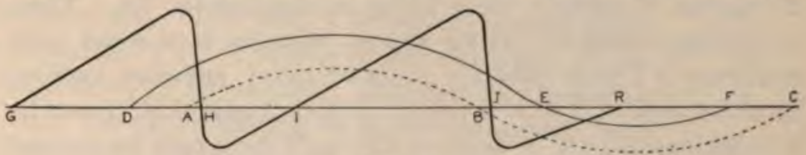


FIG. 12.

Now, as has been suggested, the same analysis applies in a general way to the subjective attention-wave. To apply the scheme, we need to omit only the dotted curve, which represents change in the stimulus, and suppose that the stimulus is constant. The combination of the active and the passive attention-wave follows the same principle here as where the change is objective. It is easy to observe in the attention-wave experiment how the effort is exerted only at the point of coming in and the point of going out of the sensation; between these points the sensation holds the sway of consciousness and the clearness of the sensation during the middle period is in no way proportional to the effort of attention.

Have we not here discovered one of the secrets of endurance, a principle of economy and efficiency which applies to all mental activity? Are not the two experiments here discussed — the one in which the change is objective and the one in which the change is only subjective — fundmental types of attentive consciousness? This most elementary periodicity is not peculiar to continuous work under pressure. It is a characteristic of the ordinary mental activity even if there be only a single act of a few seconds duration.

Observe its working in simple observation, sensory or logical pursuit, constructive imagination, reasoning, etc. — processes which require attention. Frequently, however, only the *To* period is present, there being no demand for *Tu*. Thus, in noticing whether a certain sensory stimulus is or is not present, there is a most effective spurt of active attention until we become aware of it (if it is perceivable) but, after that, it remains in consciousness for a moment although there may be no need of it, and there has been no objective strengthening of the stimulus. This is true not only of liminal stimuli but of stimuli of any strength which need to be selected by an effort of attention. The effort which lands the impression in consciousness is momentary and intense but the continuation of the impression in consciousness in its original, or even increasing clearness, is due to an after-beat, a pulsation of the secondary passive attention-wave.

The longer waves in this special experiment also deserve a passing notice. Fig. 13 represents the changes made in the standard during the two-hour period according to the prearrangement mentioned above. It is a crude way of representing the minute-waves and the hour-waves. The numbers at the left refer to the audiometer scale; and those at the base denote the time in minutes. A comparison of this figure with Fig. III. in Pl. I. and III. reveals a striking agreement of the two records. It is especially noticeable in the long hour-wave which starts with a high crest and then spreads over a long basin and finally rises again. This demonstration of the hour-waves proves that they are not peculiar to the kind of work done in the main experiment.

Progressive Change.

Next to the periodic change in these records, our interest centers on the question of progressive change. For the purpose of demonstrating any progressive tendencies which may be present in the record as a whole, the results of the two halves of each record are arranged for comparison in Table II.

The first column shows the average *To* for the first half of each record, and the second shows the average mean variation of these on the basis of groups of ten. The third and fourth columns show the same for *Tu*. The fifth shows the width of the threshold — *To* minus *Tu*. The next five columns contain the corresponding facts for the second half. The eleventh and the twelfth columns give the differences between the two halves, the plus sign indicating loss and the minus sign gain in sensibility. The thirteenth column shows the difference in the width of the threshold for the two halves. The fourteenth shows the range of variation in *To*, *i. e.*, the difference between the highest and the lowest points in a record on the basis of one hundred acts as a unit. The fifteenth column shows the range of variation in the width of the threshold on the same basis.

In respect to sensibility, or height of the threshold (Col's 11, 12), the records may be divided into three classes: those which indicate gain (I., II., IV.); those which indicate loss (VI., VII., VIII., IX.); and, those which indicate no decided gain or loss in sensibility (V., X.). For fuller interpretation, the form of each curve should be taken into consideration. In Record III., *e. g.*, there is a progressive loss during the first two thirds of the period and a gain in the last third. It is certain that there is no general tendency in favor of loss or gain. The .5 (Col. 11) balance in favor of loss in *To* is only twelve per cent. of the range of variation in *To* (Col. 15) and is negligible; the corresponding balance in *Tu* is only .1. To what extent we may regard the records as revealing types of observers, remains to be demonstrated.

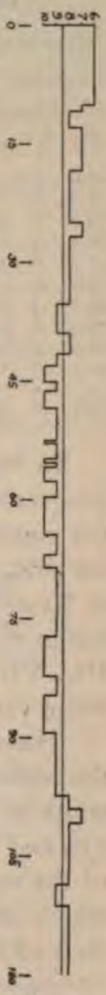


FIG. 13.

Table II.

Comparison of the First and the Second Half.

	First half.					Second half.					*To* 2d half minus *To* 1st half.	*Tu* 2d half minus *Tu* 1st half.	Width 2d half minus Width 1st half.	Range of var. of *To*.	Range of var. in Thr. Width
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Exp.	*To*	*m. v.*	*Tu*	*m. v.*	width	*To*	*m. v.*	*Tu*	*m. v.*	width					
I.	12.6	.7	9.5	.7	3.1	11.6	.6	8.7	.6	2.9	−1.0	− .8	− .2	3.9	.9
II.	16.8	.6	14.6	.6	2.2	15.1	.6	12.8	.6	2.3	−1.7	−1.8	+ .1	4.5	.5
III.	19.8	.6	17.1	.6	2.7	21.8	.5	18.7	.7	3.1	+2.0	+1.6	+ .4	6.9	1.1
IV.	20.3	.4	18.5	.4	1.8	19.6	.4	17.3	.5	2.3	− .7	−1.2	+ .5	3.6	1.1
V.	17.1	.6	14.9	.6	2.2	16.7	.4	15.3	.5	1.4	− .4	+ .4	− .8	6.2	1.7
VI.	11.4	.5	8.8	.5	2.6	12.3	.6	9.5	.7	2.8	+ .9	+ .7	+ .2	3.9	.8
VII.	25.4	.5	21.9	.4	3.5	26.1	.6	22.0	.7	4.1	+ .7	+ .1	+ .6	1.9	1.3
VIII.	16.0	.5	13.6	.4	2.4	17.6	.5	14.8	.4	2.8	+1.6	+1.2	+ .4	3.3	1.1
IX.	17.6	.9	13.8	.9	3.8	20.4	1.0	15.7	1.1	4.7	+2.8	+1.9	+ .9	4.9	1.3
X.	21.3	.7	18.5	.7	2.8	21.7	.7	17.1	.9	4.6	+ .4	−1.4	+1.8	3.2	3.1
Ave.	17.8	.6	15.1	.6	2.7	18.3	.6	15.2	.7	3.1	+ .5	+ .1	+ .4	4.2	1.3

In respect to mean variation there is still less evidence of progressive change (Col's 2, 7; 4, 9). In Records I. and V., the mean variation is slightly smaller in the second half than in the first, *i. e.*, the records tend to improve in regularity; and, in Records IV., VII. and IX., it is larger in the second half, but in no case is the difference very great. In five records (I., III., VI., VIII., X.), and in the average for the ten records the mean variation is practically equal for the two halves.

There is a more decided progressive tendency in respect to the width of the threshold. Eight records show an increase in width in the second half as compared with the first (Col's 5, 10, 13), and the average increase is .4, which is thirty-one per cent. of the average variation in width (Col. 15). In the two records which show a decrease in width, the change is very small in Record I. and, in Record V., it is partially explained by the introspective record.[1]

---

[1] According to the introspective account the exceptionally large increase of width in Record X. is accounted for in part as due to a change of standard of certainty. The uniformity in Record II. is due in part to a conscious effort to avoid the widening of the threshold.

Correlation of Changes.

In retrospect, we may review the three kinds of changes with reference to periodic changes, progressive changes, and the correlations of the three factors, by means of the juxtapositions drawn in bold outline in Pl. III. and the table of correlations, Table III.

Pl. III. contains outline reproductions of the ten records. The curves are drawn on the basis of averages for one hundred acts for each point and represent *To*, *m. v.*, and threshold width. For the present purpose, *Tu* would be similar to *To* which is used. The *m. v.* here used is the mean between the

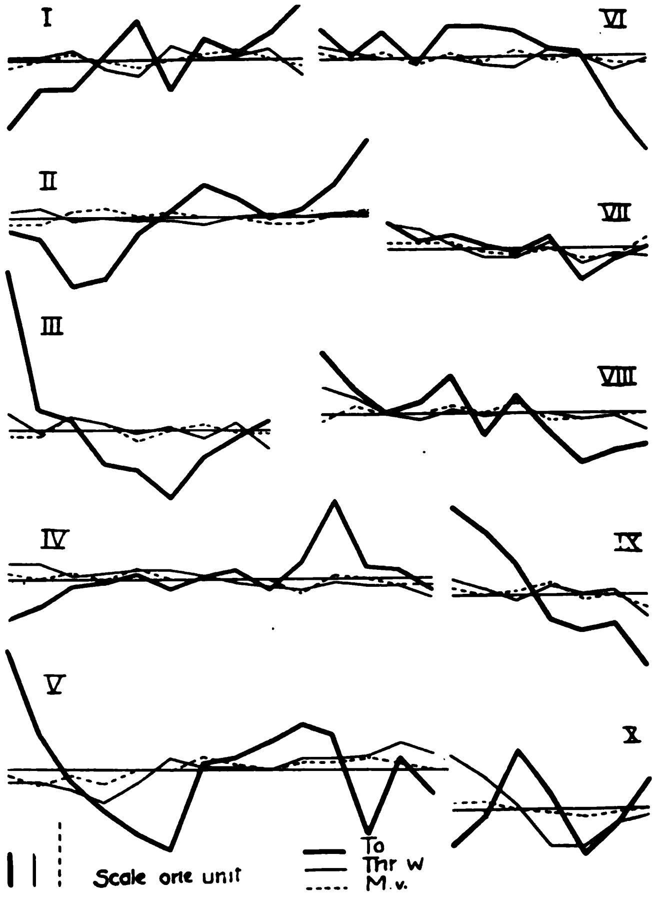


PLATE III.

average mean variation for *To* and the average mean variation for *Tu*. The ordinate scale is twice as large for the *m. v.* as for the other two curves. The horizontal line is a common base and represents the averages of the respective factors for the whole record.

The same data on which the figures in Pl. III. are based are treated by Pearson's formula of correlations. The results are presented in Table III.

For the purpose of this correlation, a point — *i. e.*, the average of one hundred acts, following the grouping indicated by the heavy horizontal bars in Pl. I. — is considered high or low as follows: for *To*, a point lying above the average for the whole record — *i. e.*, indicated by a smaller number than the average in the record of hearing — is considered high; for *m. v.*, a point represented by a smaller number than the average for the whole record is considered high; and, for threshold width, a threshold narrower than the average is considered high. Agreement of high with high, or low with low points is represented by the plus sign; disagreement by the minus sign. *n* denotes the number of points considered.

TABLE III.

CORRELATIONS OF *To*, *m. v.*, AND THRESHOLD WIDTH.

	n.	Correlation between *To* and width.	Probable error.	Correlation between *To* and *m. v.*	Probable error.	Correlation between width and *m. v.*	Probable error.
I.	10	—.64	.11	—.09	.21	+.54	.13
II.	12	+.05	.19	+.12	.19	+.49	.13
III.	9	+.40	.15	—.26	.20	+.25	.20
IV.	14	—.37	.14	—.06	.18	+.65	.09
V.	14	—.04	.18	—.12	.17	+.75	.06
VI.	11	+.31	.17	+.60	.11	+.34	.17
VII.	9	+.79	.07	+.86	.06	+.55	.14
VIII.	11	+.79	.06	+.36	.17	+.02	.20
IX.	7	+.62	.13	+.47	.18	+.79	.07
X.	7	—.10	.25	+.04	.25	+.90	.04

The column for *To* and threshold width shows six positive and four negative cases. This does not prove that no correlation exists, but rather points to the existence of radically different types of method in working. This view is borne out by intimate knowledge of the conditions of the experiment and by the introspective observations.

The columns for *To* and *m. v.* show a similar divergence, although there is a stronger preponderance in favor of a positive correlation.

There is a strong correlation between the *m. v.* and the threshold width. This probably means that *m. v.* (variability) and width (alertness) are signs of the same general central efficiency. If the *To* (sensibility), had remained constant in the record of a period, the decline in the central process would indicate that there was an increase in the peripheral efficiency. But in view of the conflicting types of the records we dare not draw the conclusion that there is a progressive increase in peripheral sensitiveness.

‘*Before*’- *and* ‘*After*’-*Tests.*

The before- and after-tests were intended to show what effect, if any, the long test had upon the ear not used. A marked change in the relation of the sensibility of the two ears would indicate that a peripheral change had taken place in the ear used.

TABLE IV.

THE ‘AFTER’- AND THE ‘BEFORE’-TESTS.

	After as Compared with Before.				Ear Used as Compared with Average of Long Test.				Before-Test. Ear Used, as Compared with First 100 Reactions of Long Test.		After-Test. Ear Used, as Compared with Last 100 Reactions of Long Test.	
	Ear Used.		Ear not Used.		Before.		After.					
	To	*Tu*	*To*	*Tu*	*To*	*Tu*	*To*	*Tu*	*To*	*Tu*	*To*	*Tu*
I.	−10.0	−10.3	−4.6	−4.3	+10.9	+11.4	+ .9	+1.2	+8.8	+9.2	−3.3	−3.4
II.	− .7	− .3	−4.0	−4.6	− .9	− .7	−1.6	−1.0	−1.3	−1.2	− .1	− .2
IV.	− 2.9	− 3.3	−6.1	−7.0	+ 3	+ 2.9	+ .2	− .4	+ .8	+1.1	− .3	− .3
V.	+ 3.5	+ 3.9	−3.6	−3.1	− 4.5	− 4.7	−1.0	− .8	− .8	− .6	−1.8	−2.1
VI.	− 4.8	− 4.4	+ .8	− .4	+ 6.4	+ 6.2	+1.6	+1.8	+7.4	+6.8	+1.3	+1.0
VII.	+ .3	− .8	+ .7	− .6	− 1.8	− .4	−1.5	−1.2	− .9	− .3	−1.4	− .8
VIII.	+ 3.7	+ 5.1	+1.7	+1.4	0	− 1.1	+3.8	+4.0	+1.9	+ .1	+2.8	+3.6
IX.	− .4	− 1.8	−4.6	−5.8	− 1.1	− .1	−2.4	+1.9	+1.6	+2.1	−3.3	−2
Average.	− 1.4	− 1.5	−2.2	−3.1	+ 1.5	+ 1.7	0	+ .2	+2.1	+2.2	− .8	− .5
Median.	− 3.5	− 1.3	−2.6	−2.2	− .5	− .3	− .4	− .6	+1.2	+ .6	− .9	− .8

To supplement the graphic records in Pl. I., the significant features of the results are exhibited in Table IV. Here a minus sign indicates ‘keener sensibility’ and a plus sign the opposite.

The after-test as compared with the before-test shows a gain in sensibility, if we consider the average or the median for the eight records, and the gain is practically equal for the two ears. But, in view of the radical divergences in the records, very little significance can be attached to the average or median.

The average and median for the ear used as compared with the average of the long test show an approximately equal distribution above and below that average, both in the before- and the after-tests, although the deviations on both sides are large.

There is a closer agreement between the end-tests and the respective adjacent ends of the long record; there is a slight tendency for the before-tests to be inferior to the first hundred acts of the long record, and for the after-test to be slightly superior to the last one hundred acts in the long record. This shows how the sensibility in the end-tests depends upon what portion of the hour-wave such a test is taken in.

There are special explanations for some of these divergencies. The receiver was not tied on, but was held to the ear by the hand, and slight changes in the adjustment would cause differences in the intensity of the sound. The pain from continued pressure may have influenced some observers in the adjustment of the receiver for the after-test. The subjective conditions of the end-tests as compared with the main experiment, and of the end-tests as compared with each other, seemed to influence different individuals in different ways. Thus, in the before-tests, the initial impetus of volition came in to the greatest advantage; in the main experiment, the calm adaptation to a uniform act was effective; and, in the after-test, the heightened irritability and the sense of opportunity for a final spurt played significant rôles. We had hoped to eliminate these and many similar sources of error by taking the test on both ears, both at the beginning and the end, and by making the end-tests of the same nature as the main experiment. But the data obtained are significant chiefly in pointing to individual differences and complexities of conditions. Three[1] of the records (I., VI., VIII.) show a decidedly greater gain in the ear used, one (VII.) shows neither gain nor loss in either ear, and four

---

[1] To these may be added a fourth, taken on Observer III., but not included in the table because it was taken under somewhat different conditions.

(II., IV., V., IX.) show a decidedly greater gain in the ear not used.

Introspective Accounts.

A general view of the experiences in a period, especially the difficulties and sources of error, may be obtained in part from the introspective accounts. In the following extracts from the accounts which were written by the observer immediately after the experiment, the language of the observer is used, but irrelevant material is cut out and much is abridged.

I. (D. S.) 10:25 a. m., April 16, '04.

The only disturbances that were noticed in this experiment were due to my changing position on the chair. * * * This occurred three or four times. It is my impression that the threshold was about the same at the end of the record as at the beginning, for the reason that I felt scarcely any fatigue from the work. There were places about the middle of the record where there was a tendency to become inattentive and sleepy. There was also a strong tendency throughout the entire period to react rhythmically.

II. (G. H. K.) 9:54 a. m., April 21, '04.

The observing-room was cold, owing to a mistake in the ventilating. A subjective sound was heard all the time, especially at first; this was very confusing. I expect to find great irregularities in the record. The duration of the sound varied greatly. There were several drowsy periods during which there was a tendency to fall into rhythmic action. The time seemed long. During the last half hour I felt much discouraged. I had visual imagery of what was going on in the recording-room. My imagination was very active the whole time.

III. (C. E. S.) 9:54 a. m., April 12, '04.

Only light work before the experiment. Air good, and a good day in general. The only discomfort I suffered was in holding the receiver. It should be tied on both to avoid fatigue and to secure constant adjustment. Slight movements of the receiver cause both qualitative and intensive changes in the sound.

I suffered no serious mental strain, still I found that I held my mouth open all the time so that my throat felt parched at the end of the experiment. I did not have any sleepy spell. There was nothing particularly wearying in the process. The quiet and darkness of the room are so soothing, the stimuli are so delicate and graceful, and the feelings of expectancy are so generally satisfied that I experienced an agreeable complaceny and comfortable adaptation as the experiment progressed. I did not get tired and felt no relief from the change at the end.

The duration of the sound seems to fit my attention-wave nicely. The gradual rise and fall of intensity led me to image a combined auditory, visual, and motor-wave which was decidedly pleasing and had great carrying power. Any interruption in this wave was disturbing, but such disturbances sometimes served to make me more alert. There was a tendency for me to shorten the period in the rhythm and 'rush' the experimenter, and I had to break away from that periodically.

The experiment is conducive to mind-wandering. The noticing of the *To* takes but a small fraction of the time and then one soon learns to estimate the time for the *Tu* from the strength of the sound immediately after the response to the *To* so that there is a freedom from suspense which really should be present.

IV. (C. P. S.) 1:32 p. m., April 26, '04.

(The account of this observer gives a vivid description of the characteristic experience during a period, and is, therefore, inserted in full.)

My physical condition was not of the best, for a severe cold made it impossible for me to breathe through my nose, consequently the whole of the mucous membrane of my mouth and throat became exceedingly dry and parched, necessitating a considerable degree of effort and swallowing to moisten it. Invariably these muscular efforts of my throat and tongue made my sense of hearing seem very much less keen, and on nearly all occasions I was compelled to give the 'objective' signal. This condition was to be noticed more during what might be judged to be the first half of the period than during the latter half; but was nevertheless a frequent factor to be dealt with.

The first portion of the period seemed on account of its novelty and my comfortable position to pass rapidly, and to be full of interest. My attention turned naturally to the experiment in hand, and I felt that I was making a splendid record, for the intervals between my responses were very short. However, as the comfort of my position decreased, and the necessity for changing the position of my limbs and body grew, my attention waned also, until I was suddenly called back to the matter in hand by what seemed an unusually loud and prolonged sound in the receiver. I felt such a time to be proper for a change in position, which I made, at the same time giving the signal. Immediately thereafter I again became conscious of a greater degree of attention.

During about the middle portion of the period, and again later, an element of disturbance arose; namely, the penetration of sound caused by someone walking in the nearby corridor. This distracted me considerably and I gave the objective signal, after which my degree of attention again increased.

A desire to leave my position and stretch body and limbs became almost irresistable during the latter portion of the period; but the belief that the period might be nearly over kept me to my task. A further desire to know how much time had passed returned repeatedly; but this was thrust away by the argument that if I turned on the light and consulted my watch, my attention would be completely distracted, if for only a moment, and the validity of the experiment impaired. This train of thought and the first desire mentioned both contributed to my lack of success in quickly discriminating between silence and sound.

A frequent desire for deep inhalations of breadth, something like yawning came over me, and my yielding to the desire was the cause for several of my signals.

One thing I noticed at intervals throughout the experiment was the loud and violent beating of my heart. This usually followed some change of position and was quite a disturbance. I was most conscious of it when giving almost breathless attention to the receiver. Pulsation of the blood in my temples was also almost sufficient to drown the fainter sounds in the receiver.

Toward the end of the experiment I became conscious of a considerable pressure, almost equal to pain, in the pinna of my ear, caused by the receiver.

At one time a train of thought about my foot-racing started in my mind and I experienced the same violent throbbing of the heart and tingling of the nerves which I experienced just before every athletic contest. This was another source of disturbance, but concentration of attention was sufficient to cause it to disappear as quickly as it came.

The long sound in the receiver which indicated the end of the experiment proper caught me in a perfectly passive condition, responding automatically to the stimuli. I received it, however, with considerable relief, and yet with a certain reluctance for which I cannot account.

So far as I can tell, there was no difference in the preliminary test in the hearing ability of either ear. In the final test I noticed no difference in the relative hearing ability of the left ear as compared with the preliminary test or as compared with the experiment proper. When testing the right ear, however, the first few tests were very poor on account of an improper adjustment of the receiver. With the assistance of the left hand I then held this in a better position, responding with the right hand. The strain of the awkward position of the left arm made me very attentive to it as well as to the receiver which it supported; and I found my hearing ability in this ear so far as I could tell, to be better than that of the left.

When the experiment was over I felt as though I had just finished a period of severe study. No great degree of physical fatigue was noticeable. At no period during the experiment was I able to judge of the amount of time which had passed.

During the first part of the period I sat with my eyes wide open staring into the dark. Many flashes of colored light were visible. Later I sat with my eyes shut because of fatigue in my eye-lids and the distraction caused by winking. With my eyes closed I also observed the many colored lights.

V. (M. B. C.) 9:35 a. m., April 15, '04.

I was in good physical condition. The period was quite free from disturbances, except such as came from slight changes in position. During the first third, I was conscious of my breathing and of both mental and physical strain. During the second third I was conscious of fatigue of both mind and body, and of mind-wandering. Expected the experiment to end. During the last third there was a sudden sense of relaxation and ease, mentally and physically. With the exception of pain from the pressing receiver, this period was the most comfortable and I felt a keener interest in the test than before; but I was aware of making many mistakes. During the whole experiment I had about five or six distinct cases of mind-wandering.

VI. (M. C.) 8:42 a. m., April 19, '04.

For the first fifteen minutes or half hour, the test seemed entirely pleasant and I seemed to be in a sort of a dream. This part of the record is probably best. After that my head began to ache on account of the bandage, and that distracted my attention somewhat. During the entire test I could notice that my attention would be exerted in waves and it seemed that after a slight movement of the head the record would improve for a time. The headache made the test seem extremely long and tiresome. I began to anticipate the end of the test at what I should judge was about the middle of it. Early in the test, before it became unpleasant, I caught myself falling asleep although I did not seem to be drowsy. The quality of the sound seemed to change from time to time. There also seemed to be a difference in pitch and the higher sounds were much easier to hear.

VII. (R. E. K.) 1:33 p. m., April 25, '04.

During the first half hour it was easy to keep the attention on the work and I think my keenness of perception was gradually increasing without any marked rise or fall. The next half hour was made up of irregular rises and falls, and it was harder to focus attention, due in part to the discomfort caused by the receiver and by the limitation of movements. It was easier to give attention to the work, after varying the position, *e. g.*, from the erect position to leaning on the table. Gradually I became drowsy and 'came to' with a start thinking that I had neglected to respond; this tended to focus my attention upon the sound for a while. These periods were quite short and were followed by drowsiness. At about the beginning of the last half hour, or twenty minutes, I succeeded in rousing myself. I think the record was gradually growing better at the end of the experiment. I am sure that my threshold was lower at the end than at the beginning of the experiment. During the last half hour it was not difficult to give all my attention to the work; no thought was given to time as was the case in the middle of the experiment.

VIII. (O. H.) 9:35 a. m., April 18, '04.

During the first ten or fifteen minutes of the experiment, the pulse beat was perceptible in the head. Perhaps this was due to the band which held the receiver against the ear. About the end of the first twenty minutes I experienced, but only for a moment, a peculiar lack of sensibility or a numbness all over the body. The experiment seemed long. For a few minutes near the end of the experiment I was disturbed by continual swallowing of saliva. Part of the time the experiment seemed rhythmical. I felt weary from continuing in the same position.

IX. (C. G.) 1:31 p. m., April 20, '04.

I was in good physical and mental condition. Felt sleepy about three times. Shifted the receiver twice because it hurt the ear, but do not think that that caused much disturbance. The time seemed long.

X. (A. W.) 10:17 a. m., April 9, '04.

I found the sounds of my own body, breathing, etc., somewhat of a disturbance at first. It was often necessary to take a long breath to catch up. My arm and hand holding the receiver went to sleep. A queer feeling was also felt in the other hand. At first I think I gave the signal for the disappearance of the sound before such was really the case, because I was listening for a certain quality of sound. About twenty or twenty-five minutes before the close of the experiment I got very drowsy and was conscious of responding almost automatically, and here I am sure that I listened for a certain sound — not merely sound — and signalled when this particular sound appeared and disappeared. After this I aroused myself and found that I could distinguish the beginning of sound which was much fainter than the 'certain' sound I had heard before.

The time seemed short, perhaps two-thirds as long as it actually was. I had a distinct feeling of aloneness when the sound ceased and a mental image of the sound was present all the time. Sometimes I pressed the key to keep out the sound, which was then more like a presence than a mere sound.

SERIES II. DISCRIMINATION.

Problem, Apparatus, Method, and Observers.

The same plan as was pursued in the study of sensibility in Series I. was here pursued in the study of discrimination. Experiments consisting of an uninterrupted series of determinations of the sensible discrimination were carried on for two-hour periods. The act remained uniform throughout, accessory conditions were kept as constant as possible, and the observer was expected to exert the maximum effort in attention to the act.

The act studied consisted in *determining whether the second of two consecutive sounds, which differed in intensity only, was stronger or weaker than the first.* The same apparatus was used as in Series I. and the conditions of the observer were also similar. The threshold of hearing was first determined and then a point about ten units above that was made the standard. In minor details three different methods were used.

In the first two experiments, Records I. and II., the sound was started at the standard and sounded two seconds at this and at each successive point, the movement being either up or down, and the observer gave a signal as soon as he knew whether it was weaker or stronger than at the beginning. Two signal keys were used: pressing the right hand key indicated a stronger and, the left hand, a weaker sound. Immediately after the response the experimenter cut off the sound for an instant while sliding the carrier back to the standard. This interruption served as a signal for the beginning of the next act. An assistant recorded the responses and the amount of change required for each successive act of discrimination, as indicated by the audiometer.

The next three experiments, Records III., IV., V., differed from the first in the following respects. The sound was held at the standard approximately five seconds, instead of two as before, and the rate of change was not perfectly uniform because the experimenter did not use the metronome. The response was made by one key, one tap denoting stronger and two taps weaker. In experiments III. and V. a time signal was given to the observer every fifteen minutes.

The results of these five experiments are represented graphically in Plate IV., Fig's I. to V. As it turned out that more than half of the responses were made for a single step of change, it was found practicable to use the number of correct responses in a single step of change as a measure of the efficiency. Since nearly all the responses which were not made for one-step changes were made for two-step changes, the method reduces itself to the tabulation of the number of correct responses on the smaller step. But this makes it necessary to deal somewhat arbitrarily with the incorrect responses on that step. Since the chances were equal that a response would be right or wrong, one correct response was deducted from the total with every error; thus, if there were eight correct responses and one wrong, the final record would read, 70 per cent. right. The zigzag line shows the average number of correct responses, on this basis, for each successive ten acts. The short horizontal lines denote averages for a hundred acts each. The long horizontal line shows the average for the whole record. The time is marked in minutes on the base-line.

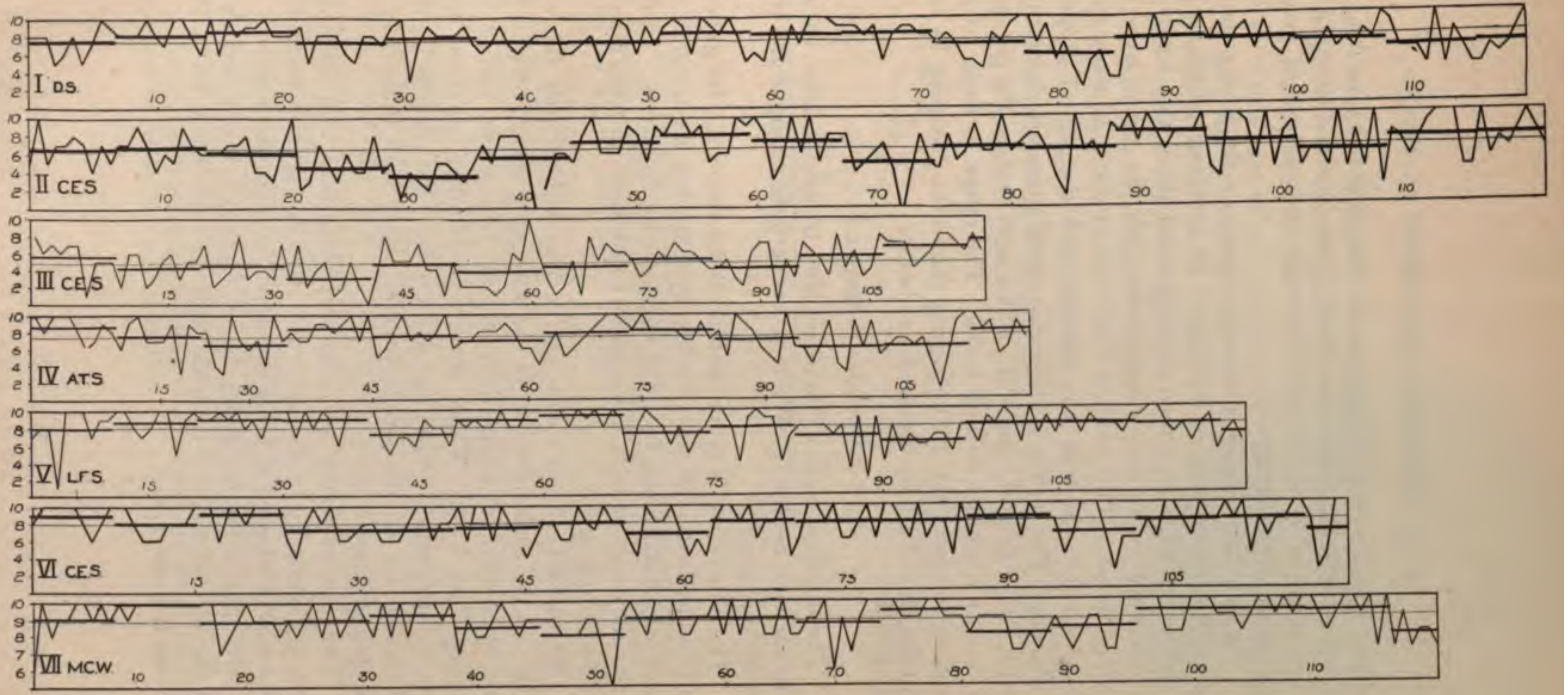
Experiments VI. and VII. were made by the method of right and wrong cases. A metronome with relay was introduced into the circuit in such a way that the sound was cut out for a second every alternate second. Either the standard or a compared tone, perceptibly different in strength, could be sounded at the will of the experimenter; but it was agreed that the standard should never be sounded more than twice in succession and the compared sound not more than once at a time. The experimenter made the change by sliding the carrier while the sound was interrupted.[1] The observer was required to signal every time the compared sound was heard.

The carrier on the audiometer (to show whether the standard or the compared sound was given), the metronome (to furnish a time-line and to indicate the duration of each sound) and the observer's signal key (to register the signal) were con-

---

[1] The difference was three steps on the audiometer in experiment VI., and two steps in experiment VII.; and the compared sound was weaker than the standard in the former and stronger in the latter.

PLATE IV.


I DS.
II CES
III CES
IV ATS
V LFS
VI CES
VII MCW
10
8
6
4
2
9
7
10
15
20
30
40
45
50
60
70
75
80
90
100
105
110

nected with corresponding pens in the multiple recorder[1] by means of which a continuous tracing was obtained showing the correctness or error of each response, and, in case of errors, the nature of the error.

Two kinds of errors occurred: signals on the wrong sound, and failures to signal on the right. In counting points for the graphic record, the correct responses and these two kinds of errors were taken into consideration, but the errors were not differentiated. This method leaves out of count all those cases in which the standard was sounded and the signal properly withheld. The results of these two experiments are represented in Pl. IV., Fig's VI. and VII. The curves show the per cent. of correct responses on this basis. The range is from 50 per cent. to 100 per cent. The zigzag shows the grouping by tens and the short bars by hundreds, as before.

Periodic Changes.

The interpretation of these records is simple, after we are familiar with Series I. We look for periodic changes and progressive changes.

The hour-wave is prominent in all the records. Its general outline can be traced most readily by following the trend of the short horizontal lines, *i. e.*, the averages by hundreds. In this series they appear both more distinct and more uniform than in the foregoing series.

Record III. shows a close agreement with records III. and XIII. on the same observer in the foregoing series, both in the long hour-wave of which there is only one phase, and in the shorter hour wave. These three records taken together indicate a characteristic individual wave series; but records II. and VI. which are on the same observer agree with these only in the shorter hour-wave.

The minute-waves are also very prominent and there is a striking similarity in the records. But the present method is not entirely adapted to bring out detail in these short waves.

Here, as in the foregoing series, there is a strong tendency for the second-wave to coincide with the individual act. The time was suitable, and the new effort made at each beginning on the standard was conducive to the adjustment of the attention-wave to the duration of the act.

---

[1] See reference, p. 60.

The distraction of introspection was avoided, as far as possible, in the regular experiment. But afterward, some experiments were repeated for the purpose of determining by introspection whether the combination of active and passive attention follows the same principle in the act of discrimination as in the act of simple perception.

We may illustrate the conclusion by reference to the simplest form of comparison in discrimination. In Fig. 14, let the dotted figures AB and CD represent two successive tones. The duration of each tone is one second and the interval between them is one second. The act consists in determining whether the two tones are equal or different in intensity.

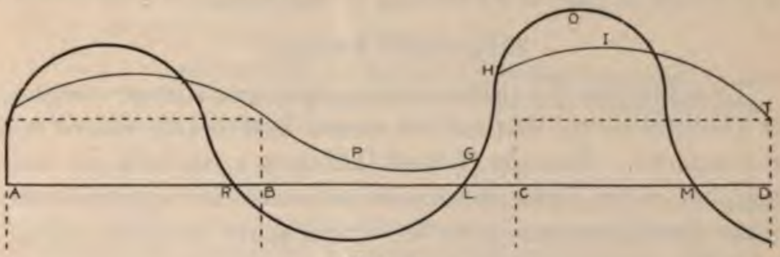


FIG. 14.

The general form of the attention-wave in which the whole act is comprehended may be outlined by the composite curve $ANPOJ$.[1] But this may be reduced to its component elements; namely, the secondary passive wave $APGHIJ$, and the two active attention-waves ANR and LOM. That is, the combination follows the same principle as was illustrated for sensibility in Fig. 12, p. 63: the act is performed largely by secondary passive attention, but at the critical points, short intensive waves of active attention occur.

This illustration presupposes a trained observer performing a familiar act under the conditions named. The proportions of the components would vary with observers and conditions, but

[1] N was cut out from the etching inadvertantly; it represents the first active attention-crest and is symmetrical with O.

certain relative features are rather fundamental. (1) The two stimuli and the memory image of the former are grasped in a single wave of attention. (2) Active attention comes into prominence only at the critical moments. It does not cover more than the first part of each stimulus and the end of the memory image. (3) Both forms of attention rise higher for the last than for the first stimulus. There is also a wider scope of attention at the beginning of the second stimulus but this cannot be represented in the plane figure. (4) The early rise of the second active attention-wave is due to the effort to grasp the passing memory image and to take advantage of the sharp edge of the appearing stimulus. The rise of the passive wave at the same point is due in part to the feeling of suspense.

Progressive Change.

To determine the presence of progressive change roughly, the averages for the first and the second half of each record may be compared. Records II. and III. show a rise of 6 per cent. each, but in the latter the rise is accounted for approximately by the special impetus given for a final spurt by a time signal; and in the former, the absence of the usual high beginning for this observer is conspicuous. Five records show a decline in ability as indicated by the following per cents. respectively: I., 8 per cent.; IV., 3 per cent.; V., 10 per cent.; VI., 1 per cent.; and VII., 2 per cent. On the whole, therefore, there is a tendency toward decline in ability in this period of work.

Notes from the Introspective Accounts.[1]

I. (D. S.) 9:30 a. m., June 8, '04.

I was in good condition for the test. Felt drowsy for three-fourths of an hour about the middle of the experiment. I also felt drowsy for a quarter of an hour after the experiment. The duration of the sound at the standard seemed to vary; this was disturbing.

III. (C. E. S.) 3:10 p. m., June 4, '03.

Good physical and mental condition. In the fourth quarter I had difficulty in keeping awake. Each quarter-hour signal aroused me to a keener discrimination. The signal gave a feeling of relief. I often moved slightly and the change of position broke the monotony. The absence of light was exceedingly soothing.

---

[1] Abridged as in Series I.

There was no sense of increased fatigue during the second hour. In fact I felt brighter in the second hour than in the first, especially in the approach to the end.

The errors are due to various reasons. Among the objective, the following may figure: the uncertainty of the tap on the key, movements of the receiver, and irregularities in the time of the stimulus. Among the subjective factors, are, mind-wandering, failure to remember the standard, and hesitation in reaction.

The observer felt no after-effect of the experiment until 9 p. m. Then he felt an unusual pain above the eyes and a more decided feeling of general exhaustion than usual. There are no means of knowing whether these effects were or were not due to the experiment.

IV. (A. T. S.), 2:45 p. m., June 3, '03.

The period seemed short. I felt sleepy once and caught myself distinctly mind-wandering twice. I enjoyed the experiment and took special pleasure in the opportunity to do my best.

V. (L. F. S.), 3:35 p. m., June 3, '03.

I felt as if I had swayed backward and forward for fifteen seconds. In the last quarter, or half hour, I gritted my teeth as if I had been running an engine down grade. Do not feel tired.

VI. (C. E. S.), 2:33 p. m., April 7, '04.

The experiment began immediately after an afternoon lecture from which I felt tired. The step seemed too large throughout. There was no considerable period during which I felt any distinct incapacity for discriminating. The mistakes seemed to come singly, and most of them could be traced to some temporary inattention, movement, distraction, or lapse into rhythm. I was quite comfortable all the time. The darkness and silence of the room were distinctly restful and quieting. I felt a distinct relief from the strain of the lecture room and from stimulation of the eyes, and thought that this room would be an ideal resting place.

The work was not exhausting. There was a distinct tendency to automatism. It was possible to carry on a process of reasoning without making any mistakes in the discrimination. (?) It may be that the tendency to perceive rhythmic accentuation (intensification) led me to think that I was right when I was not.

The time seemed to drag, *i. e.*, I kept accelerating and had to realize from time to time that my subjective standard of time had changed. I was sleepy once, at the end of the first fifteen minutes.

I had a distinct and helpful pitch association. The strong tone seemed to be the fundamental (do) and the faint seemed to be the fifth of the octave below it (sol). I frequently judged entirely by this pitch difference, which was probably due to the prominence of the first overtone in the stronger sound.

VII. (M. C. W.), 3:40 p. m., June 11, '03.

The quality of the tone varied. The time passed quickly, and I did not feel tired at the end. I had short lapses of attention which seemed to serve as periods of rest; but I exerted a strong effort all the time. During the first fifteen minutes I felt dizzy. There was a strong space association, the weaker sound being localized further away.

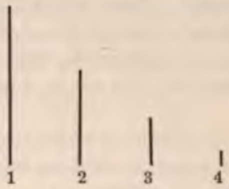
SERIES III. MEMORY.

Problem, Apparatus, and Method.

The following requirements were kept in mind in the planning of this test: (1) The work shall consist of a difficult act of memory which shall be repeatable under uniform conditions, without interruption, for any desired length of time. (2) There shall be only one variable element in the complex act; all variable associations and disturbing sensory stimuli shall be eliminated as far as possible and the motor process shall be reduced to a minimum and uniform act. (3) All elements in the complete act of memory, namely, impression, retention, reproduction, localization, and expression, shall be involved in the same way at every step. (4) The work shall be the result of continuous maximum effort. (5) A detailed record of efficiency shall be obtainable.

With these ends in view, the following act of memory was chosen: *Given four clearly distinguishable intensities of the same tone in succession, to signal the order of succession in a group after the order in the next following group has been observed.*

The psychological relations of the intensities of the tones may be represented by the relations of these lines:



Number 4 was so faint that it could just be heard distinctly, 1 was as strong as it could be without being disagreeable to the ear, and 2 and 3 were adjusted between these limits empirically in such a ratio that the steps 1–2, 2–3, and 3–4 were equally perceptible.

The procedure may be illustrated from the beginning of an experiment by giving the part of the observer, as follows:

Receives the first group, *e. g.*, 2 1 3 4.
Receives the second group, *e. g.*, 3 2 1 4.
Reproduces the first group, 2 1 3 4.
Receives the third group, *e. g.*, 2 4 1 3.
Reproduces the second group, 3 2 1 4.
Receives the fourth group, *e. g.*, 4 1 3 2.
Reproduces the third group, 2 4 1 3.
Receives the fifth group, *e. g.*, 1 4 2 3.
Reproduces the fourth group, 4 1 3 2. Etc.

Thus the same act, namely, *observing the order of four sounds in a group and reproducing it after another group has been observed*, could be repeated for any length of time without serious change in the setting or relative value of the elements in the group. The selection of this particular act made it possible to comply approximately with all the five requirements enumerated above.

The sounds were produced through a telephone receiver in the secondary circuit of an inductorium, the primary circuit of which was completed as a shunt around a 100 v. d. electric tuning-fork.

A system of four open-circuit keys was inserted in the primary circuit of the inductorium. Each of three of these was in circuit with resistance coils, respectively, as follows: key 2, 35 ohms; key 3, 670 ohms; and key 4, 4,845 ohms. By closing a key, the inductorium circuit was completed through the corresponding resistance and this change in the current produced the desired gradation of the sounds heard in the receiver. This gradation was determined empirically by a sufficient number of trials. The experimenter produced the stimulus sounds by playing upon these keys.

The observer signalled his reply by a similar system of keys, each of which was associated with a given sound. Thus, the sounds were numbered 1, 2, 3, 4, in order of their strength, beginning with the strongest, and the keys were numbered 1, 2, 3, 4, running from left to right. Hence, if the sounds appeared in the order 3, 2, 4, 1, the proper reply would be to press the response keys in that order.

A record of the stimuli and the responses was taken in a

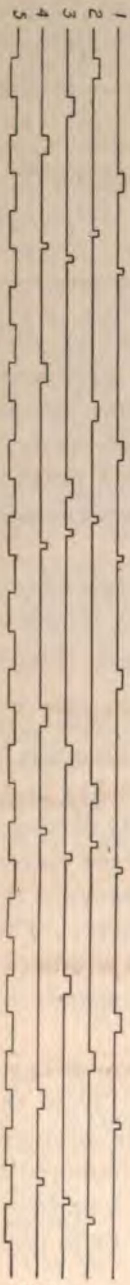


Fig. 15.

continuous tracing by the multiple recorder.[1] Each of the stimulus keys was connected with a pen on the recorder, and each of the response-keys was connected with the same pen as the corresponding stimulus key. The fifth pen in the recorder traced a time-line in seconds. A portion of a record is reproduced in Fig. 15.

Each section contains first the group of four stimuli and then the group of four responses to the group received in the preceding section. Thus, the first response we cannot tell anything about because the stimulus is not on the record, but the second response is correct because it corresponds to the first stimulus group: the third response is wrong in part because it reads 4, 2, 3, 1, instead of 4, 2, 1, 3; and the fourth response, again, is correct. The record also shows the time of each stimulus and each response.

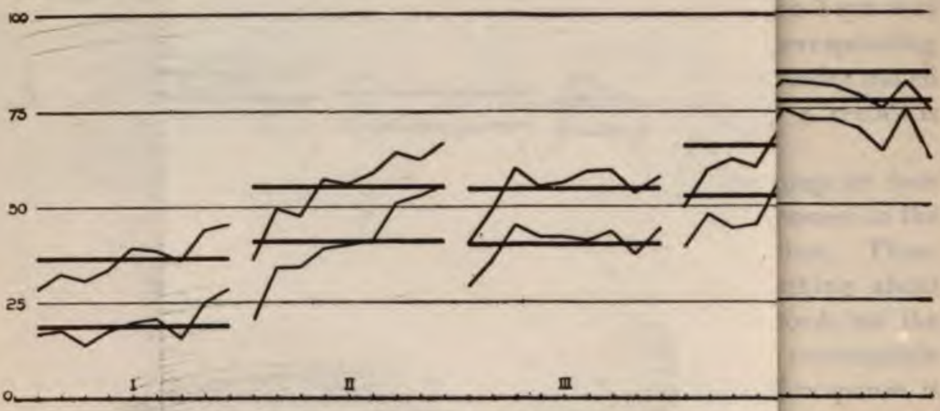
In regulating the time-order, the experimenter was guided by the beat of a metronome. The record shows that the sounds were produced at the rate of one per second, and that each sound lasted one half second. It also shows that an interval of four seconds was allowed for each group response and that the individual responses were given short and in quick succession so that the observer saved some time in which to change from the expressive to the receptive mental attitude.

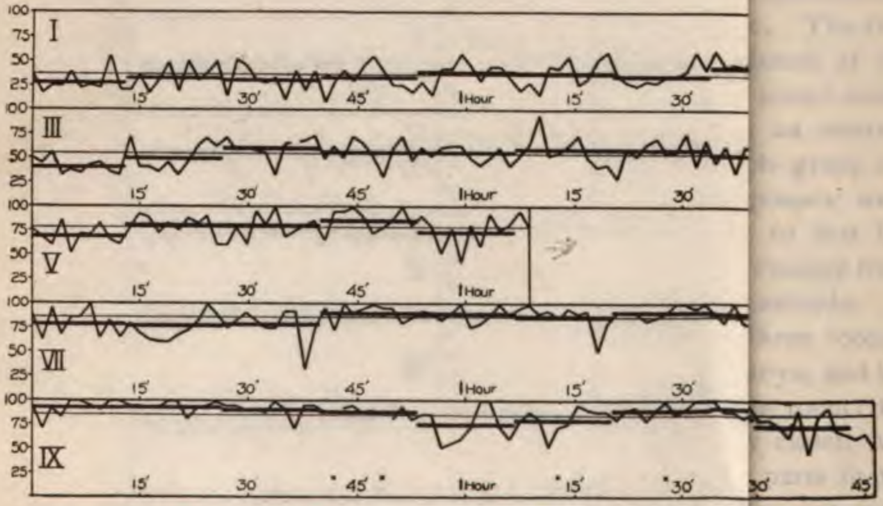
The apparatus was distributed in three rooms: the telephone receiver, the response keys, and the inductorium were kept in the observing room; the fork was kept in the distant battery closet, and the experimenter had the remaining parts in the measuring room. The observing room was moderately lighted with an incandescent light.

There are twenty-four possible mutations of the stimulus group with four sounds, but as two of these (1234 and 4321) are decidedly easier than the

---

[1] See references.


100
75
50
25
0
I
II
III


100
75
50
25
I
III
V
VII
IX
15'
30'
45'
1 Hour
15'
30'
30'
45'

rest they were excluded and the remaining twenty-two mutations were used approximately in the order in which they would occur by chance.

The experiments here reported consist of a single series of nine periods taken upon one observer, Observer I., in Series I. and II., as follows:

LIST OF EXPERIMENTS.

Experiment.	Date.	Began.	Continued.
I.	Feb. 9	9:04 a. m.	2 hours.
II.	" 11	9:04 "	" "
III.	" 16	9:15 "	" "
IV.	" 18	9:08 "	" "
V.	" 20	8:37 "	1 hr. 13 min.
VI.	" 23	9:14 "	2 hours.
VII.	" 25	9:13 "	" "
VIII.	Mar. 1	8:57 "	" "
IX.	" 3	7:29 "	4 hrs. 48 min.

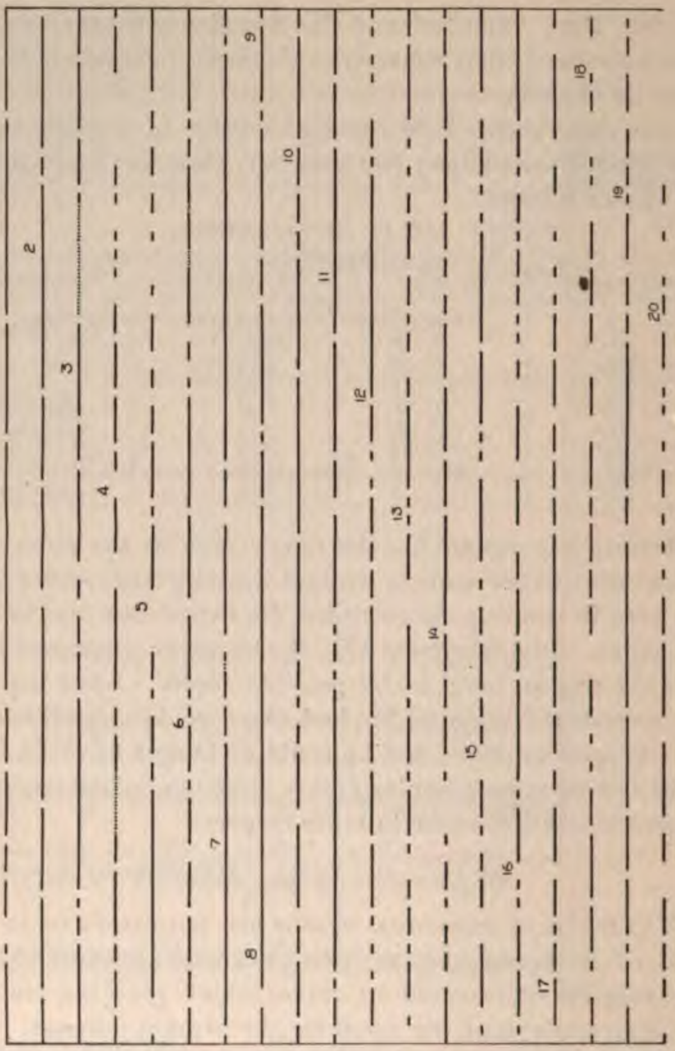
During experiment V., the repair man at the power house cut out the electric current without warning and, as the current was used in running the recorder, the experiment had to stop at that point. In experiment IX., the observer attempted to continue the test as long as he possibly could. After four hours and forty-eight minutes, he had to cease because his hearing had changed so much that he could no longer hear the faintest of the sounds in the stimulus group, although he had not reached the end of his endurance in other respects.

Explanation of the Records.

The tables of numerical results are too extensive to be introduced here, and they are not necessary, because the main facts may be represented in curves which give the true relief and show enough of the detail for the present purpose.

Pl. V. shows the results of the whole series *en gros*. Each link in the curve as a whole represents one experiment period. The base-line is laid off in units of one hundred acts. Since each act takes eight seconds, these units may also be considered time units of eight hundred seconds, or 13.3 minutes each. The time-line extends one unit to the left of each curve because the beginning point in each curve represents a hundred acts. The per cent. of success is indicated by vertical distances.

PLATE VII.



The degree of success is expressed in two curves which run nearly parallel. The upper indicates what per cent. of individual signals — out of a possible four hundred — were correct in each group of one hundred acts. The lower curve shows what per cent. of complete acts were correct in the same periods. The difference between the two curves is that successful parts of acts were counted for the former whereas only successful whole acts were counted for the latter.

For the two-hour periods, there are nine points in each curve. The average for the whole period is expressed by a heavy horizontal bar over each curve. By these means we are enabled to see at a glance the general trend of the progressive change and the existence of the long periodic changes. The figure as a whole is a fatigue-curve, work-curve, memory-curve, curve of 'learning,' etc., according as it is viewed from one point or another.

Pl. VI. shows the same results more in detail. Here the record contained in the upper curve of Pl. V. — the per cent. of success, counting both whole acts and parts of acts which are correct — is represented in units of ten acts for each point. Each point in the zigzag curve denotes the average per cent. of success in ten acts. Averages for a hundred acts each are represented by the heavy horizontal bars, and averages for the whole record of a period by a light horizontal line. The numbers of the sections here, as in Pl. V., correspond to the list of periods, dates and durations in the above table. Pl. VI. shows the hour-waves and the minute-waves quite well.

Finally, to show the 'makes and breaks' in the continuity of power still more expressively, the data contained in the lower curve of period IX. are represented in a special manner in Pl. VII. Success in whole acts is represented by a line, and failures by breaks in the line. It shows the distributions of the ratios of success to failure. Thus, from the beginning, the record reads: Nine successes, one failure, one success, three failures, four successes, one failure, three successes, one failure, seven successes, etc. The three small-dotted parts indicate objective disturbances. The numbers indicate the ends of the successive hundreds of acts.

Extracts From the Introspective Accounts.

February 9. — At the beginning of the experiment, I attempted to find some method to aid in the remembering. I tried to remember the sounds by their numbers, by directing special attention to the first two sounds in a group etc., but abandoned these in favor of the attempt to retain the sensory image of the group as a whole. This change of method produced great irregularities in the first part of the record.

February 11. — To-day the series was not so fatiguing and no change occurred in the way of trying to remember the succession of sounds. Toward the last it seemed comparatively easy and it seemed that a small number of sound conbinations were used over and over.

February 16. — I do not think that this record is any improvement over the last one. I did not feel so bright as last time — possibly on account of the close air in the room. I could not concentrate attention so well. The period seemed longer than the last one. * * * The strength of the sound series as a whole seemed to vary several times * * * in the latter part the sounds seemed fainter for a short time.

February 18. — To-day's record is better than the last one, and possibly better than any preceding record. There were no special disturbances except twice, probably at the change of classes.

February 20. — To-day's record is, I think, an improvement over the preceding. About 85 per cent. to 90 per cent. of the reactions may be correct. * * * The periods of attention and relaxation [minute-waves] seemed to have changed considerably. In the first and the second records I took, I should estimate that the periods of attention and relaxation are about equal, but in succeeding records the period of attention seems to have increased in length gradually.

February 23 and 25. — The observer wrote no introspective accounts on these days, because he had nothing special to record. He was aware of the continued practice gain and in both cases his estimates of the degree of his success was approximately correct.

March 1. — During the last part of this period the sound series seemed to grow stronger so that it caused confusion of the sounds. There were also some irregularities in the duration of the sound stimuli. The direct effect of these disturbances lasted for a short time only, but the thought of them tended to recur and was especially effective in distracting my attention because this took place in the last part of the record when I was fatigued and more subject to it.

March 7. — During the first few records I memorized the stimuli largely by visualization. I responded according to the impression of the successive louder or fainter sounds, not taking notice of particular ones of a group. Then I associated each stimulus with the key corresponding to it, and whenever a group was given I would glance from one key to the other in the same succession as the given stimuli. At the same time one or two of each group began to become more conspicuous on account of their position or intensity, *e. g.*, the first and last ones of a group or the place of the loudest or faintest ones, but especially the former. If the first one and the last one of a group were together, *i. e.*, if the corresponding keys were together, they would be the more conspicuous ones. So my memorizing depended largely upon the reference to the key board. Some groups were more easily remembered than others. Such are, 1324, 4231, 2134, 1243, 3421, 3412, 2341, 3214. In these the conspicuous features were noticed more easily and much earlier than in the others. But the more difficult ones were also memorized in the same way but more slowly, so that some were not thought of by their peculiar features until the last two or three records. These noticeable features of the various groups afforded a basis for 'names' of the groups so that at last I had a name for each group as follows:

(The keyboard was thought of not as a horizontal plane but as an inclined plane of which the end with the loudest sound was up and the end with the faintest sound was down.)

1324 = Zigzag down.
4231 = Zigzag up.
1342 = Two together, up.
4213 = Two together, down.
1432 = One up, three down.
4123 = One down, three up.
2341 = Three down, one up.
3214 = Three up, one down.
2134 = Both pairs from the center, up.
3421 = Both pairs from the center, down.
2143 = Both pairs up, up.
3412 = Both pairs down, down.
2413 = Parallel down.
3142 = Parallel up,
2314 = Two in the center, down.
3241 = Two in the center, up.
1423 = Up, down.
4132 = Down, up.
1243 = Straight down (except the last two are reversed).
4312 = Straight up (except the last two are reversed).
2431 = Triangle below.
3124 = Triangle above.

It never occurred to me until now that the remembrance of these groups depended so much upon the motor action of my right hand as it really does. As I am writing these groups and their 'names' I cannot give many correctly without actually performing the taps as if on the keyboard. After these names had become quite familiar, I had a feeling of confidence that I could give almost every response correctly unless I had been too inattentive to get the group correctly when it was given. Whenever I had clearly grasped a group I was certain that I could remember it with the aid of its names and give it correctly in the response. But before I had these names for the groups the occurrence of the second group would frequently cause me to forget the first, although I had it clearly in mind just after it had been given.

During the intervals between the stimuli I repeated the name of the group to be given after the next stimulus by actual movement of the mouth. I was unconscious of it and did not know it until I caught myself doing it. The movement of the hand in giving the response was almost entirely automatic so that I needed to attend only to the incoming stimuli. I was also unaware of breathing except when I happened to take a deep breath.

During the last record fatigue did not consciously affect me until about the end of the third hour. I became inattentive on account of a drowsy, sluggish or sleepy feeling. Whenever I would take a different position on the chair it would serve to make me more attentive. About a half hour before the end of this record I occasionally felt a stinging pain in my ear. This became more frequent and intense until the fourth or faintest sound was not perceptible at all, and then I decided to stop.

For nearly an hour after, I felt pain in the ear from time to time. I did not seem to be fatigued very much until two or three hours afterward. I felt as though I had done hard manual labor.

In reply to a request for fuller information in regard to the disposition of the time allowed for an act, the observer wrote, under the date of March 18:

> As each sound of a combination was given, I glanced at the corresponding key and as soon as the third sound was heard, I knew the whole combination of four sounds so that, immediately after the last sound, I could turn to the preceding combination and respond at once. The reaction was almost automatic. After the response, I returned to the new combination and repeated its name but discontinued this long enough before the appearance of the next sound to be fully prepared. If I failed to allow time for preparation, I frequently failed to get the new combination.

Periodic Change: A. Hour-waves.

The hour-waves are quite as pronounced and uniform in this series as in Series I. and II. They may be seen both in Pl. V. and Pl. VI. Thus running the eyes along the curves in these plates, we see two and one half sinoid waves in each of Periods I., III., VII., and VIII.; three waves in Periods IV. and VI.; three and one half in Period II.; and one in Period V., which is incomplete. (Cf. the records on the same observer in Series I. and II. — Fig. I., Pl's I., and IV.)

About the same length of waves are found in Period IX., but they are here disturbed by the presence of longer waves which seem to be due to the awareness of the length of the task. The great depression of the long wave, one phase of which occupies two hours, is due in part to a temporary disturbance, the stopping of the fork. The points at which the forks stopped are marked with stars in the figures. These disturbances were only of a few seconds duration each and the loss is eliminated in the averaging for the groups in which it occurred.

Periodic Change: B. Minute-waves.

The same minute-waves which we are familiar with from the other series are here in evidence. They appear conspicuously in Pl. VI. in which their regularity is somewhat exaggerated by the want of detail. To show them with absolute fidelity, the record for Period IX. is represented in detail in Pl. VII. but here it is difficult to trace them on account of the confusion of these with the longer waves.

Periodic Change: C. Second-waves.

Here as in the preceding series the second-waves are present and can be obtained by analysis of the act and introspection. The form and combination of the attention-waves go through progressive changes throughout the series. For the purpose of simplifying the presentation, we may examine the distribution at a given stage, *e. g.*, the last record.

Fig. 16 shows in a schematic way the form and composition of the wave in a typical act at this stage, the stage of the highest mastery of method. The long bars 1, 2, 3, 4, represent the time of the four stimuli in the group which is to be impressed. The short bars 4, 3, 2, 1, show the time of the responses to the impression received in the preceding act.[1] There are three waves of active attention: *A–B*, to the act of receiving; *C–D*, to the act of responding; and *E–F*, to the repetition of the group which is to be retained. After each of these, there is a depression denoting the absence of this form of attention. The wave of passive attention is continuous for this act, although it shows certain characteristic fluctuations. A glance at the curve reveals these fluctuations better than a verbal statement.

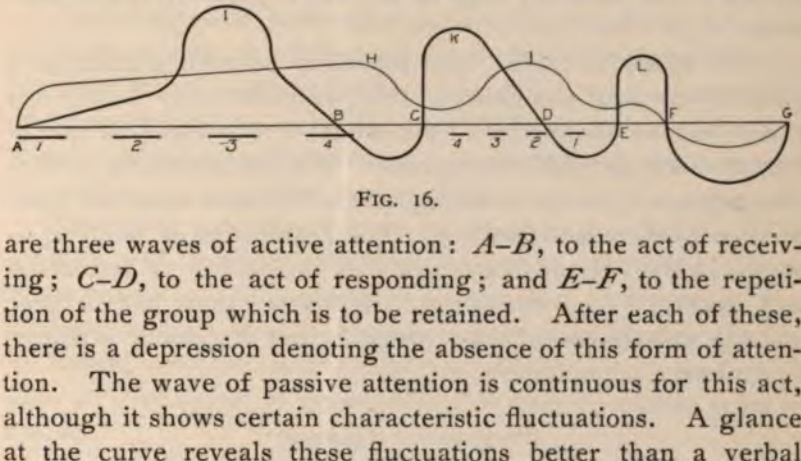


FIG. 16.

The distribution complies with the general requirement, that the active attention shall be more impulsive and take more rest than the passive. Both forms have negative phases from *F* to *G*, but the active attention has two other pronounced negative phases, namely, *B–C* and *D–E*.

The receiving process clearly divides itself into active and passive stages. The crest, *I*, denotes the fact that, at the beginning of the third stimulus in the group, the fourth was predicted and the order of the group was analyzed and impressed, by a well concentrated effort. After a moment's relaxation, there was another decisive mustering of forces in the act of recalling the order which was to be reproduced; the motor process of the response was semi-automatic. Following another moment of relaxation, there was a short but well regulated effort, *L*, in the reviewing of the image which was being retained. Then both forms of attention drop in preparation for renewed efforts.

---

[1] By mistake in lettering, the two orders, 1 2 3 4 and 4 3 2 1, which were not used, appear in the figure.

The actual distribution varies from the type described, not only in the series as a whole, but in successive acts at this particular stage of practice. In fact, the progress of learning might be illustrated in terms of the progressive change in the composition of the attention-wave. So also every temporary fluctuation in efficiency may be described partially in the same terms.

This leads us to the question, Is it possible to maintain a perfect record for two hours in this particular act? All we can say is that the elimination of occasional errors would be an extremely slow and difficult process. The attainment of perfection depends upon the power to adhere to a most economic composition of the attention-wave. The distribution of failures, as shown in Pl. VII., indicates that it is possible to be systematic and successful for a considerable period at a time, but the hour and the minute-periodicities break in and the result is disturbance in the second-wave.

Progressive Change.

Examination of the curves in Pl. V., with reference to progressive change, reveals especially the following features: (1) There is a gradual increase in efficiency from the beginning to the end of each of the first seven periods, provided one neglects the periodic fluctuation and regards only the general tendency. The second and fourth periods show the greatest rise, and the third and sixth the least. (2) Periods VIII. and IX. both show progressive decline in efficiency. (3) There is a tendency for each successive period to start from the vantage-ground gained in the just preceding period. The rise of the series, however, shows three plateaus; the third day is on the same level as the second; the sixth is on nearly the same level as the fifth; and the eighth and ninth are on about the same level as the seventh. (4) With increasing efficiency, the two curves tend to run closer together.

The curve as a whole is a practice-curve, but not pure and simple, for various other elements are involved in it. The act was appallingly difficult to the beginner. It was so much more than he could do that it required the greatest determination and perseverance in pursuit of the goal — mastery by practice. This goal he never quite reached, yet he came near it, and made a remarkable progress with practice. What was the nature of the improvement? The discussion of that might be considered the principal topic of this report, but we must content ourselves with merely a brief reference to it.

According to the observer's account, supplementing his written introspection, the following were important factors in the learning, or acquisition of power by practice: (1) Distributing energies, (2) finding method of receiving, (3) development of a visual scheme of associations, (4) automatism of the response, (5) naming, (6) repetition, and (7) rest.

Before the recording began, the observer had had no more practice with this act than was necessary to enable him to understand the requirements. At the first attack there was naturally a good deal of hesitation as to what part of the act he should concentrate his energies upon first. It was impossible to give uniform attention to the whole array of parts in the act.

This led to a skirmishing for methods — methods of receiving, methods of retaining, methods of reproducing. This skirmish was most noticeable during the first third of the first period. As a rule he was not aware of deliberately trying this or that method; there was a sort of desperate effort to get something in any way possible, and reflection shows that this resulted in the bobbing up of different methods which may be differentiated.

The general method soon found and afterward followed consisted in falling back upon a very concrete visual scheme of associations which grew gradually toward perfection and realism. The scheme was not merely visual; the motor element was prominent and contributed much to the realism. Consciousness was distinctly visual-motor. The situation was alive! The observer became oblivious to all else and threw himself entirely into this melee. It was not abstract memory; it was a play. Each sound was merely the signal of a combatant who had to be located and his lunge parried.

The development of power in this act of parrying consisted in the formation of automatisms, just as the acquisition of skill does in the fencer. From this point of view, this act of memory resolved itself into a hierarchy of acts in which one grade after another was mastered in succession.

Still improvement consisted largely in progressive unification. Groups were gradually identified as wholes having striking peculiarities which gave rise to names. The names were descriptive and served as motor cues. The identification and naming led to the perception of the limitation of the number of variations, and this resulted in the development of a feeling of familiarity and ease which was decidedly conducive to endurance.

All these shortenings increased the spare time and it soon became possible to take advantage of that by recalling the impression which was to be retained while waiting. This repetition strengthened the retention as soon as it could be done without too much sacrifice of rest.

But the acquisition of time for rest and the habit of the most economical use of this rest constitute the most potent factors in the development of power of endurance.

Features like those here enumerated account for the profit by practice up to the highest point reached. That point seems to be approximately a physiological limit.

The observer accounts for part of the decline in Period VIII. on the ground of objective disturbance. That disturbance seems to have been overestimated and was probably chiefly subjective, but it brought on a mood or attitude which is the chief cause of the depression. For this reason, it is not safe to draw any conclusion in regard to progressive change in this period, except to state that a decline occurred.

The decline in the long final period is pronounced and decisive.

PART IV. GENERAL CONCLUSIONS.

The conclusions upon individual points are so tersely stated in the text that there is no need of repeating them here; but it may be profitable to restate some of the broader generalizations from the investigation as a whole, stripped of their technical garb.

Our primary aim was to develop methods of controlling and recording definite forms of continuous mental work in the hope (1) that we might pave the way to the experimental study of such facts as fatigue, adaptation, learning, and the effect of various conditions and stimuli upon the efficiency of continuous work, and (2) that certain general characteristics of mental work might be demonstrated in such faithful records. The results may, therefore, be summed up with reference to (1) method, and (2) certain characteristics of the efficiency of continuous mental work: (*a*) periodic change and (*b*) progressive change.

I. *Method.*

The methods here introduced for the measuring of prolonged mental work differ essentially in type from the methods in vogue, such as the adding method, the nonsense syllable method, routine work methods, the ergograph method, etc. Our methods seem to have advantage over every other method heretofore used in one or more of the following respects:

The work is mental.

The work is relatively homogeneous.

The work is reduced to fundamental types and relatively controllable conditions.

The measurements are continuous and in sufficient detail.

The measurements are on the work itself and not on injected tests.

The general principle is adaptable to different types of mental work.[1]

---

[1] It takes but little ingenuity to adapt the general principle of measurement here employed to the different senses, and to fundamental types of cognition and action. But this is only the first step; the methods must be used under specific conditions for specific purposes, *e. g.*, by Kraepelin's pause-method in the study of fatigue.

II. *Periodicity.*

1. *Periodicity a General Characteristic of Mental Work.*[1]

The three fundamental and representative types of mental activity studied, sensation, discrimination, and memory, exhibit alike a thoroughgoing periodicity. There is a continuous gradation from the period of the momentary active impulse up to the hour-long waves of mental efficiency. The efficiency in a given period, say two hours, may be represented by an irregular wave, the resultant of a series of partials.

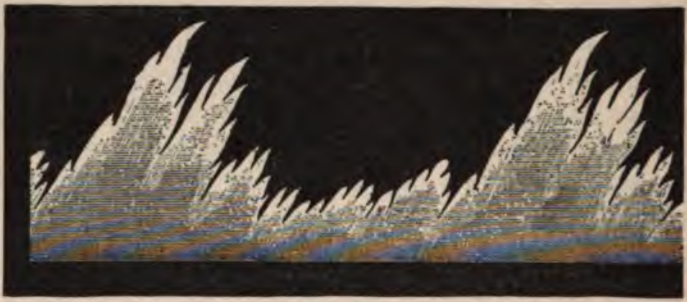


FIG. 17.

Such a wave is analogous to the synthetic wave made by combining the fundamental and a dozen or more series of partials of a vibrating string. The typical fluctuations in mental efficiency under these conditions might well be represented by the well-known composite curve from the manometric flame shown in Fig. 17.

2. *Second-waves.*—Such periods of mental activity as are grasped in uninterrupted waves of attention.

Attentive work runs in elementary periods the length of which depends upon the individual and conditions of work but does not ordinarily extend more than a few seconds.

The attention-wave of Urbantschitsch is typical of this periodicity whether the stimulus is strong or weak, constant or variable, objective or subjective.

---

[1] The word periodic is not used here in the mathematical sense of exact equality, but in the sense of approximate or relative equality of period. The factors which condition the fluctuations are so exceedingly complex and variable that there is no reason to expect such beautiful and exact symmetry as is shown in Fig's 16 and 17.

This wave is composite: it consists of relatively long waves of secondary passive attention and one or more relatively short waves of active attention.

Active attention appears only at the crucial points; the bulk of the second-wave is secondary passive attention. Active attention constitutes the determining moments and secondary passive attention bridges the gaps between these.

In a complete attention-wave, *i. e.*, a second-wave, there is one moment at which both active and secondary passive attention are at rest (not present). Unless the act consists of a single impulse, there are two or more moments of rest from active attention, but the secondary passive attention never has more than one.

The second-wave is irregular in outline, being the resultant of two components which vary with the individual and the conditions of the work.

3. *Minute-waves.* — Periods which contain more than one second-wave but are less than twenty minutes in average length.

Beyond the second-waves, attentive work runs in short composite waves; these combine in series as partials of longer waves and exhibit the phenomena of interference and reinforcement.

When the work is such that it may be perfect for considerable periods of time, as *e. g.*, the memory work after long practice, these waves do not show in the objective record, but introspection reveals their presence through fluctuations in ease, certainty, concentration, etc., and through awareness of mind-wandering, ennui, dullness, and other more or less certain accompaniments of change in capacity.

4. *Hour-waves.* — Periods lying between the minute-waves and the well-known diurnal waves in length.[1]

Beyond the minute-waves, attentive work runs in one or more series of long composite waves of efficiency. These are distinguished from the minute-waves because they are probably the result of different conditions from those which underlie the shorter waves.

---

[1] By diurnal waves, we mean such daily rhythms in efficiency as are due to routine work, eating, sleep, recreation, etc.

The hour-waves tend to get shorter as the work progresses.

There is no evidence of any constant tendency of observers to begin the work at the moment of greatest efficiency, or any other particular phase of the work curve.

5. *Correlation of Changes.* — Keenness of sensibility (*To*) and alertness (threshold width) are not closely correlated.

Keenness of sensibility (*To*) and variability (mean variation), are not closely correlated.

In these two cases it is not so much a question of degree of correlation as of type of tendency; some individuals give a high positive correlation and others give an equally high negative correlation.

Large variability (mean variation) and lack of alertness (threshold width) are highly correlated.

6. *Individual Types.* — There are evidences in these records to show that each individual probably has a fairly characteristic type of waves for similar work done under similar circumstances but at different times. This is true of all, from the short second-waves to the long hour-waves. This individual characteristic may show even in as radically different work as the three forms here employed.

7. *Consciousness of Change.*—The shorter the wave, the more clearly the observer is aware of the change. Introspection can always grasp the second-waves, but hour-waves may have large amplitude without the observer's suspicion of their existence.

The feeling of dullness does not correlate closely with poor work in waves of medium length. The very feeling of dullness comes from awareness of exertion. Low efficiency correlates better with periods of unconscious neglect, absentmindedness, mind-wandering, etc., which become known only as we catch ourselves in such shortcomings and forthwith make a new start.

8. *The Significance of Periodicity.* — The experiments were not planned so as to test any theory of the cause of all this periodicity, but it is reasonable to suppose that they are all evidence of nature's way of protecting the organism; the periods of dullness are periods of relative rest from which the observer

comes forth refreshed. It is common to speak of the failing of voluntary attention as nature's safety valve; the same figure may be extended to the whole series of periodicities.

Fatigue, practice, and adaptation errors have received critical examination in experimental method, but in these periodicities we have a factor which in many forms of experiment is as important as any of those named. In measurements for comparison which run over half an hour or more, what is only a part of wave may be taken for progressive change. This is especially so if the experiment is repeated in the same order and on the same observer who may have a definite type of periodicity.

This periodicity favors our normal working in short periods. When composing, *e. g.*, one writes during a moment of lucidity and then relaxes into a state of ennui and feeling of restriction, only to take up the period again. In free work such as that, the fluctuations are very much greater (and perhaps more efficient) than in work under experimental pressure.[1]

It has often been observed that, even in a situation of life and death, these periods of relaxation and absence of power set in, to our moral shock and great discomfiture.

These fluctuations are a part of nature's great scheme of rhythm. They are a condition of endurance and progressive mental development.

Their significance is analogous to that of sleep.

One may discover his most favorable rhythms and adapt his work to these. The art of effective work consists largely in selecting the most favorable rhythms, both long and various partials.

III. *Progressive Change.*

1. *General Tendency of Change in Efficiency.* — These experiments were not planned to isolate the factors which form a basis for progressive change. The aim was rather to secure faithful measurements of the actual efficiency from moment to

---

[1] Thus, the end tests in Series I. on the effect of a liminal sound upon the ear used and the ear not used in a two-hour period depend upon what phase of the long waves they are taken in. This is the chief reason why we could not draw any definite conclusion from those tests.

moment, regardless of the underlying shift of elements. Yet certain important progressive tendencies may be seen in the records.

2. *Practice.*—There is no noticeable gain from practice in simple perception and simple discrimination, after the observer has clear knowledge of the nature of the stimulus.

The improvement in a complex cognitive act, such as memory, is very great.

The improvement in memory work may be ascribed chiefly to progressive systematizing of parts in the act, the development of automatisms, the association of concrete imagery, and economical rest.

The practice is effective in impression, retention, reproduction, localization, and expression; but there is a tendency to make gain in one of these factors at a time. This leads to the step-like or plateau series of progressions.

The marked practice improvement ceases when the observer has reached the limit of his inventive power in systematizing.[1]

3. *Fatigue.*—Continuous liminal or moderately faint sounds do not seem to lower the efficiency of the ear in a two-hour test.

In the long period of the memory test, the faintest sound, which was clearly above the threshold at the beginning, became inaudible during the fifth hour of the work. There is nothing to show whether this is due to the long continuation of the work or to the stronger sounds in the group; nor was the test continued to determine whether this loss of sensibility was evidence of progressive or periodic change.

We failed to differentiate between the central and the peripheral fatigue by means of the 'before'- and 'after'-tests.

4. *Adaptation.* — Since the sensibility tests show no unmis-

---

[1] From the suggestion contained in these records, and from the accumulation of experimental evidences not published, we are inclined to believe that there is a general law which expresses the probability of gain by practice in any form of mental activity. This law is, *The practice gain is somewhat proportional to the complexity of the act.* In other words, where there is room for noticing new factors and simplifying, there is promise of practice gain. Simple perception and simple discrimination in the above records do not show any practice gain because the acts were simple, but the conditions of either could easily have been made so complex that there would have been a greater practice gain than in memory.

takable general rise or fall in efficiency and the discrimination tests show a fairly decisive decline; and since the strain of attention is about equal in the two tests and change in peripheral sensibility would have but little significance in the latter, it appears that there may be a general decline of central efficiency in both tests and that this is counteracted in some cases of the sensibility tests by an increase in the peripheral sensitiveness through adaptation.

5. *Types.* — The observers conform to different types with reference to progressive change. They may be divided first into those which show general gain and those which show general loss. Then each of these may be subdivided with reference to the rate of change and with reference to the time and cause of change.

A CASE OF VISION ACQUIRED IN ADULT LIFE.

BY JAMES BURT MINER, PH.D.

The opportunity of studying a case of complete congenital cataracts in which vision was not acquired until adult life is seldom given to a laboratory. About twenty cases of acquired vision have been reported in the psychological literature of Europe; in all except a few of these, sight was restored early in life.[1] So far as I can discover, there has been no psychological investigation of a congenital cataract case in this country. The present Iowa case, moreover, seems to be the first attempt to utilize the modern laboratory equipment for testing systematically and quantitatively the senses and the learning process of a blind person who has been made to see. The young woman here reported was blind from birth by reason of complete cataracts in both eyes. She was operated on when she was 22 years of age.

In order that there may be no misunderstanding, it should be stated that persons having complete cataracts can distinguish light and darkness. In the opinion of Dr. Ware, who reported two cases to the Royal Society of England, patients with cataracts 'are never so totally deprived of sight as to be unable to distinguish colors.'[2] In the famous Chesselden case the boy could distinguish scarlet previous to the operation.[3] These individuals are 'blind' in the popular and medical acceptation of the word; they make no use of their eyes in their daily work.

---

[1] W. Preyer, *The Mind of the Child*, 1889, Vol. II., appendix C., excerpts from cases of Chesselden, Ware, Home, Wardrop, and Franz; references also to cases of Hirschberg, von Hippel, and Dufour.

B. Bourdon, *La perception visuelle de l'espace*, Paris, 1902, Chap. XIII., refers at length to the above cases and also those of Albertotti, Uhthoff, and Vurpas and Eggli.

R. Latta, 'Notes on a Case of Successful Operation for Congenital Cataract in an Adult,' *British Jour. of Psych.*, 1904, I., 135–150.

The Medical Index Catalogue of the Surgeon General's Office, U. S. Army, Second Series, 1898, congenital cataracts.

[2] Preyer, *loc. cit.*, p. 293.

[3] Preyer, *loc. cit.*, p. 286.

It seems safe to say that no person absolutely blind from birth has ever acquired sight. If the nervous mechanism were intact, a blow on the eye would give the sensation of light. With cataracts, there seems to be no reason why a decided difference in the intensity of light cannot be distinguished; some notion of the distance of objects would be acquired by this means. If there is a distinction between light and darkness, when an object comes between a patient's eyes and the sun he should be able to get some sort of visual idea of diffused outline. Previous to the removal of the cataracts he might, therefore, associate a visual impression with an accompanying movement. This would give some degree of visual space perception. Franz's patient could distinguish a vertical from a horizontal line on the first trial after the operation. It seems as if this would always be possible. The patient's vision is in much the same condition as if he had always been compelled to look through a glass of milk. Not only is the transparency of the lens affected, but the refraction is also disturbed. Previous cases seem to have established the fact that after the removal of the lens the patient is not able to recognise objects with which he was perfectly familar by touch. Objects also appear larger than they did to touch; solids look like surfaces. In the points above mentioned the present case corroborates the conclusions of previous observers.

HISTORY OF THE CASE.

In this paper I can only attempt a brief preliminary report of the case which came under observation recently at this laboratory. The young woman, Miss W., besides having unusual natural ability for her age, brought to her new visual experience all the training of an excellent high school course. She is a graduate of the State School for the Blind at Vinton, Iowa. Moreover, she is a splendid introspector, as blind people often are. Having been inclined for many years, by reason of her blindness, to watch her own mental states with considerable care, she has developed a remarkably keen power of observing and describing her psychical experiences. One incident will illustrate this. When her retinal color fields were to be mapped with a campimeter, one of her eyes being covered, she was told to fix her other eye on a certain point and, holding the eye still, to tell what happened as a disk of color was drawn slowly away from the fixation point. Usually the observer will note, when the disk reaches a certain place (the limit of the field), that it disappears or changes into a different color. She, however, besides noting these facts, made the additional remark that 'just before the color leaves, it seems to grow much brighter; it almost glows.' This change in intensity is one which a skilled introspector often has difficulty in observing. Miss W. would rank well with introspectors of many years' training. Another circumstance made Miss W. particularly valuable for the series of experiments which we conducted. Her eyes had fully recovered from the operations and had been so strengthened by use that she could carry out extended tests without fatigue. She had been fitted with both far and near spectacles, so that she was able to find her way about, and could even read print with some facility.

The first successful operation on Miss W.'s eyes was performed at the School for the Blind in March, 1902, by the surgeon for the school, Dr. Lee Wallace Dean, who is also professor of ophthalmology in the medical college of the University of Iowa. The operation was that of needling, or discission of the lens of the right eye. A year later a successful discission of the lens of the left eye removed that also by absorption. As it was not until November, 1904, that we had the opportunity to study her case, she had already acquired much knowledge of the visual world. Since the first few days of sight have been so completely reported by observers of other cases, this delay was found not to be serious. Miss W. was still completely naïve to many of the normal visual experiences of an adult. She had never looked through a stereoscope, opera glass, field glass, or telescope. She had never used both eyes together enough to find out any differences between monocular and binocular vision. She had not yet learned to translate her visual images into terms of movement with any degree of success, except in case of the most simple forms and numbers or with common objects of her previous touch experience. She knew practically nothing about drawings or pictures. She had not even learned to identify people by their faces; those whom she thought she knew by their features were her mother, father, sister, a teacher at the school, and the nurse who was with her during the operations. Although I worked with her every day for over a month and she saw Dr. Dean often, I believe she cannot yet recognize either of us by sight.

There seems to be no doubt as to the congenital character of Miss W.'s blindness. Dr. Dean states that the lenses were completely cataractous at the time they were removed. He says: 'I am confident that their extent had not changed from the condition at birth.' The young woman's father says that a peculiar twitching of the child's eyes was noticed soon after birth, but the family did not realize that she was blind until she was about four months old. The family physician states that, so far as he can remember, he diagnosed congenital cataracts at about that age. It should be stated that the reason why the eyes were not operated on earlier was that the parents had been wrongly advised by an occulist whom they consulted when she was a child.

Early in her life Miss W. seems to have amused herself by trying to follow the heavy black letters in a primer. Her practice in this respect at first seems to indicate that she may have seen slightly. A further consideration of the facts as she remembers them indicates that it was only playing at reading. As she relates the experience she says she could hold a large letter close to the corner of her eye and by moving the book she could tell when she left the black of the letter. Keeping the eye still and carrying the printed letter in different directions she determined what the letter was by the movements of her arms. It may be possible that this process was aided when she was young by light reaching the periphery of her retina between the iris and lens. It is curious that the left eye which she used in this practice shows a retina which has been atrophied for nearly a third of the distance from the periphery. In Miss W.'s case there was always the ability to distinguish white from black, and as near as we can determine by questions, she could also distinguish red, blue and yellow. These colors were, however, so much duller that she hardly recognized them after the operation. She says that when she first saw her clothing it seemed to her as if she had 'an entirely new wardrobe,' the colors were so unexpectedly bright and different.

The general plan of the investigation was to first arrange a series of tests for touch, hearing, and sight by which measurements could be made of the lower, upper, and discrimination thresholds. The tests were to be standardized so that they might be used subsequently in any other laboratory in similar cases. They were also to be the basis for comparison with records from a group of normal individuals, to determine the effect of the disuse of the eyes not only upon vision, but on the other senses. Unfortunately, as yet there has not been time to prepare the group of normal records for comparison, so that the conclusions expressed in this paper must be largely tentative in nature. Another series of tests was planned to investigate her process of learning in the new field of vision. This touched a long list of problems of special interest to education, psychology and philosophy.

TESTS OF THE SENSES.

There is a popular idea that the loss of sight in a blind person is compensated for by greater keenness in the other senses. The present case offered a chance to determine how far this conclusion is supported by the facts. The tests on hearing show that Miss W.'s range of pitch is very wide. As tested by the Koenig bars and the Galton whistle, Miss W.'s upper limit is approximately 50,000 vibrations per second, and a rough test of her lower limit indicates that it is slightly below 16. Although she has this wide range of tone sensations, we found that her discrimination between simple tones was not unusually keen. With the tuning forks she distinguished, nine times out of ten, a difference of eight vibrations from the international a′ (435 vibrations). Tests with the audiometer also indicated that she was not far from the average in her discrimination and liminal thresholds for sound. Her localization ability was tested by Mr. Starch with the Seashore sound perimeter.[1] The most noticeable factor here was an inordinate tendency to move her head in order to localize the sound.

---

[1] Daniel Starch, 'Perimetry of the Localization of Sound,' *Univ. of Iowa Studies in Psych.*, 1905, IV., 1.

With the sense of touch, the pith-ball test showed no peculiar sensitivity for passive touch. The æsthesiometer tests on the tip of the forefinger were not numerous enough to be accurately stated, but they indicated that two points could be distinguished when 1½ mm. apart. Active touch was tested by a more satisfactory method. A piece of very fine steel wire (No. 35 B. & S.), 7 cm. long, was laid on a plate of glass. It was then covered with 43 sheets of letter paper (Brother Jonathan Bond, 17 × 22, 20 lbs. to the ream, 500 count). Miss W. determined correctly ten times in succession whether the wire was in a vertical or horizontal position. With 44 sheets she was right eight times out of ten. It is impossible as yet to give normal records for comparison.

So far as these tests on hearing and touch go, it seems to me that they give good evidence that training has improved her active touch and probably increased her interest in overtones to such an extent as to somewhat enlarge the range of pitch. She recognizes people entirely by their voices. For this purpose the noticing of overtones is more important than fine discrimination of simple tones. I would conclude, therefore, that the effects of training in active touch and hearing are evident, but there is little evidence that the native untrained capacity of other senses than sight has been increased. We may suppose that persons who have always seen could, by similar training from birth, make equally good records in hearing and touch.

In the examination of Miss W.'s vision, it was found that, without spectacles, she could read letters on the Snellen charts at 20 cm. distance which normally are read at 500 cm. Considering the fact that she has no lenses in her eyes, this may be regarded excellent. Dr. Dean has provided her with distance glasses having a spherical correction of + 10 diopters. According to his record her vision with these spectacles is 6/36; this means that she reads at a distance of six meters what she ought to read with normal eyes at a distance of 36 meters. Her reading glasses have lenses of + 13 diopters. With these

I found that she could read much smaller than the usual newspaper type (Snellen's D. 1.2) when she held it close to her eye. The campimeter and ophthalmoscope show that about one third of the outer part of the left retina is useless. Otherwise the relations of the visual area and color fields seem normal. Aside from the lack of lenses, Miss W.'s vision is also affected by the constant twitching of her eyes (nystagmus) and by cross-eyedness (concomitant convergent strabismus). These often accompany congenital blindness. There is some indication that the strabismus may be partially overcome, as will be explained in the discussion of binocular vision. Tested with prisms, the horizontal convergence cannot be corrected by a twenty-degree prism. A prism of from 4 to 6 degrees is necessary to correct the vertical disturbance.

The color vision of Miss W., it may be safely said, is decidedly above the average. She can detect color in solutions that are perfectly transparent to those of us who have been working with her in the laboratory. She can also discriminate differences in tint which are considerably below our threshold. In looking at the spectrum, she can apparently see ultra-violet which is beyond the usual field of view. The interpretation of her observations of the spectrum is a matter of some perplexity, so that I would not be sure of the present record without further check experiments. Preliminary work with the spectroscope indicates that her spectrum is about one fifth longer than the average of ten students. The length is added to the violet end. I suspect that this difference is largely due to a difference of interest in the test. In the examination of the color threshold and discrimination, the Lovibond tintometer was arranged for standard daylight, which was regulated and measured photometrically each day. With the intensity of light which was used, she was able to discriminate 16 times out of 20 a difference in red amounting, in the units of the instrument, to 1 in 700. Tested also for the threshold of color, she was able to name correctly red, green, blue and yellow nine times out of ten when the slides .2 were used. In the slides supplied with the instrument, .1 is the only lighter tint that is furnished. Two students who were tested became insensitive to color at slides .5 and 1.0;

they failed to discriminate reds, under the same conditions as Miss W. worked, when the difference in shade was 1 to 20. Another series of tests was started to check these results, using standard solutions of blue and red instead of the Lovibond tinted glass slides. As yet I have no records for comparison. The reaction time for discriminating white, black, red, green, blue, yellow and orange has been obtained. The examination of Miss W.'s perception of color contrast and after-images shows that in these respects she is practically like other individuals.

These facts of color vision seem to me to have some importance for biology. Twenty-two years of almost complete disuse of the retinas have caused no degeneration of the color process so far as can be determined. The tests point rather to a color vision beyond that of the normal adult. This seems somewhat contrary to what might be expected. The fact may be explained in several ways. It is possible that further tests on other adults may show normal individuals who can reach Miss W.'s record in color discrimination. Should equal records be made by any other adult, I should be inclined to believe that the pronounced difference manifested between Miss W.'s color vision and that of us in the laboratory is a difference due to her decidedly greater fascination for color. On the other hand, if the normal adult cannot equal her record, we seem to have a suggestion that the color process of the retina may degenerate with use. On account of the difficulty of interesting children in the tests, negative records made on those who are younger would hardly determine this point. The fact that there are no lenses in Miss W.'s eyes is also to be borne in mind; this may give her a clearer vision of color. So far as the evidence at present stands we seem to have several possible conclusions. The lens may obstruct our view of color, the color process may deteriorate with age, or a phenomenal interest in color may increase our liminal and differential sensitivity for light far above the average.

Apart from her remarkable sensibility to color, one of the most surprising facts thus far discovered is that Miss W. sees black objects larger than white objects of the same size. This reverses the usual illusion of irradiation. Measurement of the illusion shows that a white isosceles triangle with a base of 5 cm.

Contents of the first three volumes of the

University of Iowa Studies in Psychology

Edited by GEORGE T. W. PATRICK, Professor of Philosophy

I. 1897

Researches upon School Children and College Students, J. ALLEN GILBERT 1
On the Effects of Loss of Sleep, G. T. W. PATRICK AND J. ALLEN GILBERT 40
The Effects of Practice in Reaction and Discrimination for Sound upon the Time of Reaction and Discrimination for other Forms of Stimuli . . . . J. ALLEN GILBERT AND G. CUTLER FRACKER 62
Fatigue in School Children: A Review of the Experiments of Friedrich and Ebbinghaus 77
Right-Handedness and Left-Handedness: A Review of Recent Writings 87

Price, Fifty Cents.

II. 1899

Some Psychological Statistics . . . . C. E. SEASHORE 1
    I. Visual Perception of Interupted Linear Distances, 1
    II. The Material-Weight Illusion, 36
    III. Localization of Sound in the Median Plane, 46
    VI. Hearing-Ability and Discriminative Sensibility for Pitch, 65
    V. Motor-Ability, Reaction-Time, Rhythm and Time-Sense, 64
On the Analysis of Perceptions of Taste . . . . . . G. T. W. PATRICK 85
Some Peculiarities of the Secondary Personality . . G. T. W. PATRICK 128
New Psychological Apparatus . . . . C. E. SEASHORE 153
    I. A Spark Chronoscope, 153
    II. An Audiometer, 158

Price, One Dollar.

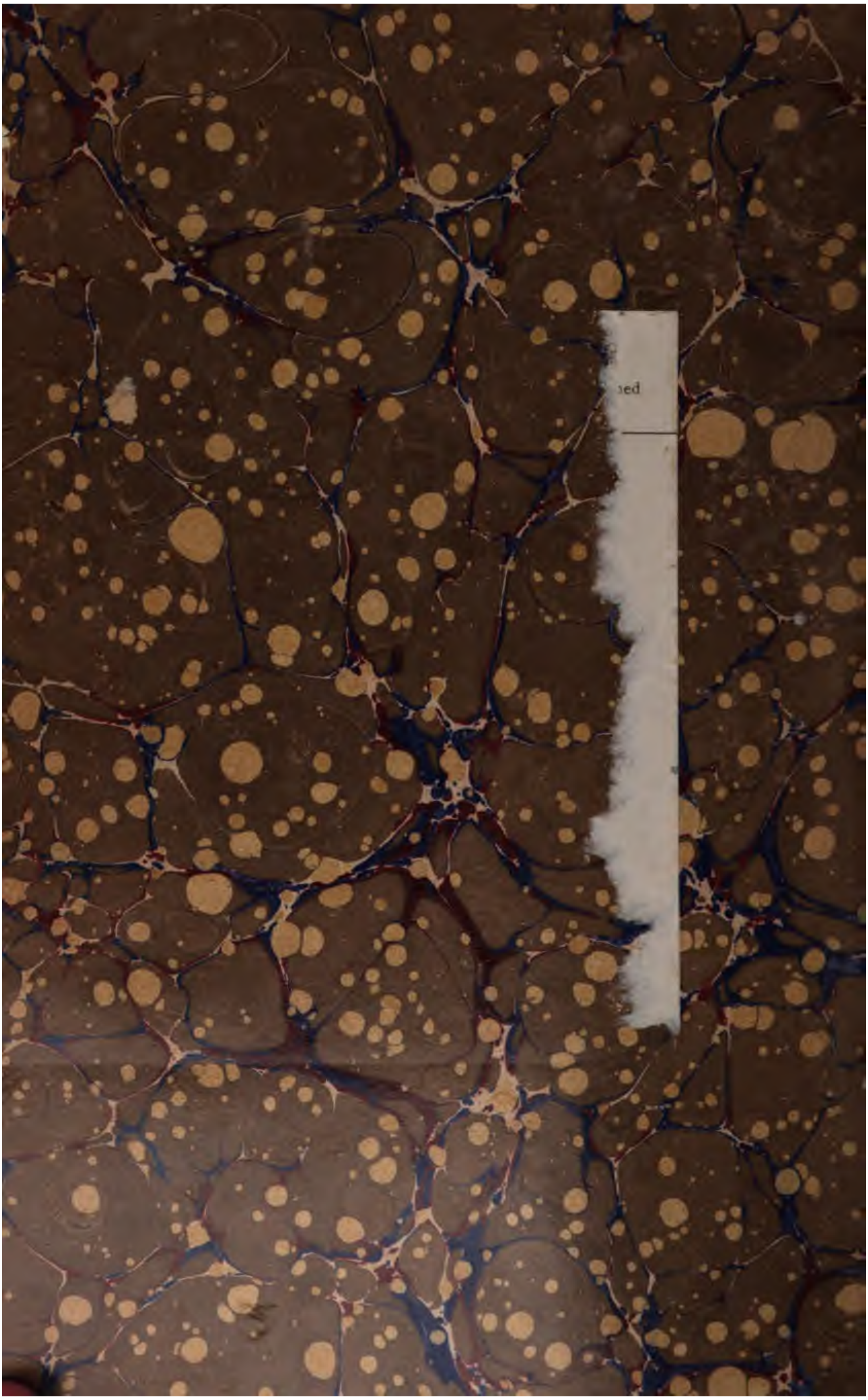
III. 1902

A Method of Measuring Mental Work: The Psychergograph C. E. SEASHORE 1
A Voice Tonoscope . . . . C. E. SEASHORE 18
An Illusion of Length . . . C. E. SEASHORE AND MABEL CLARE WILLIAMS 29
Normal Illusions in Representative Geometrical Forms MABEL CLARE WILLIAMS 38
The New Psychological Laboratory of the University of Iowa G. T. W. PATRICK 140

Price, One Dollar.

These volumes may be ordered from the Secretary of the University, Iowa City, Iowa.

The publication of the STUDIES will be continued in the PSYCHOLOGICAL REVIEW MONOGRAPH SERIES. The present volume is the first in the new series, but will be known as Volume Four. A change in the editorship will also be noticed.



ed

Stanford University Library
Stanford, California

In order that others may use this book, please return it as soon as possible, but not later than the date due.